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AUTOMOTIVE INDUSTRIES

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CONTENTS

Mass Production of Skilled Workers. By E. L. Warner, Jr.	363
Radial Engine Building. By Joseph Geschelin	368
Involute Splines by the Shaving Method	377
Hotchkiss 12-Ton Tank	378
Men and Machines	382
Ring Width and Blowby. By J. H. Ballard	386
Production Lines	388
Business in Brief	389
News of the Industry	390
Calendar of Coming Events	392
Advertisers' Index	90

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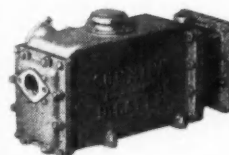
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April 1, 1941

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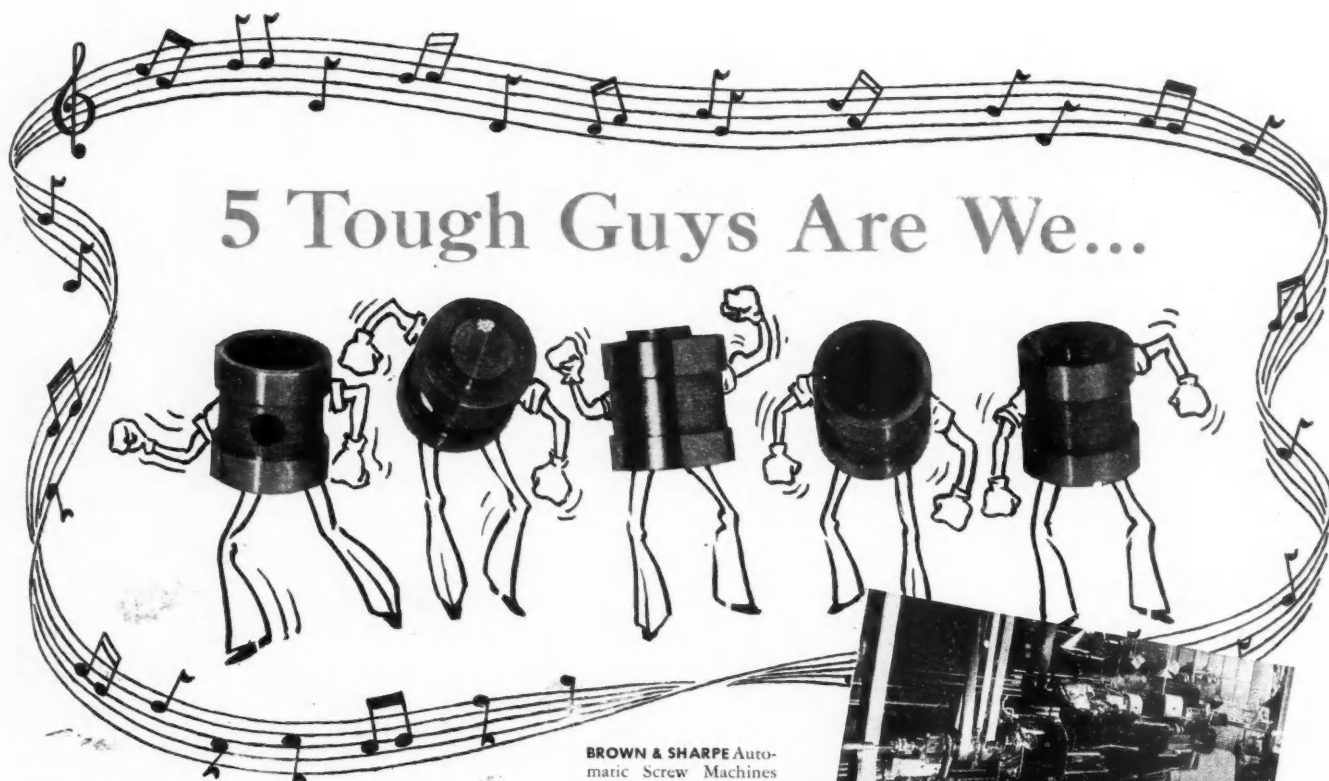
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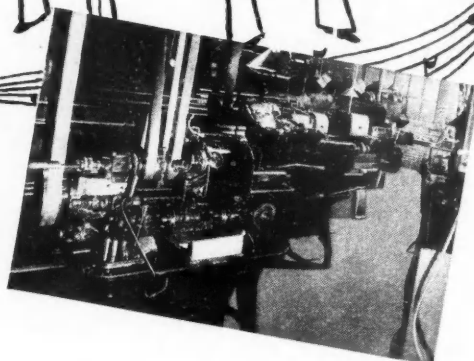
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★ MORE STATIONARY DIESEL HORSEPOWER IN THE U. S. IS LUBRICATED WITH TEXACO THAN WITH ANY OTHER BRAND.

BROWN & SHARPE Automatic Screw Machines machining pump plungers from $\frac{3}{4}$ " Stainless Steel. Coolant used is Texaco Transulutex Cutting Oil "A."



WE ARE PUMP PLUNGERS, made of *Stainless Steel*, tough, hard to machine. But this doesn't stop these B & S Automatics from turning us out at the rate of 25 an hour.

Production is up 30%, finish is better . . . and 600 of us are now turned out between tool grinds against only 450 formerly.

All these benefits were made possible by changing over to **TEXACO TRANSULUTEX CUTTING OIL "A."**

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April 1, 1941

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Automotive Industries

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 84

April 1, 1941

Number 7

Hayes Will Build Wing Panel for Dive Bombers

Hayes Mfg. Corp., of Grand Rapids, has an initial aircraft order in excess of \$5,000,000 from Brewster Aeronautical Corp. to manufacture outer wing panels for the Model 340 dive bomber used by the U. S. Navy. One of the three main plant buildings at Grand Rapids, with a floor area of 103,900 sq. ft., will be devoted exclusively to finishing and assembly of wing panels. When in full production, more than 1000 employees will be working on two shifts in this plant.

Rensselaer W. Clark has been elected president, succeeding E. C. Connolly. Clark recently was associated with the aviation section of the National Defense Advisory Commission. Other officers are A. A. Anderson, vice-president; T. E. Dean, secretary; J. H. Lee, treasurer, and E. H. Glaetli, assistant treasurer and comptroller. Elected to the board of directors at the annual meeting were William B. Cudlip, and McKee Robison, Detroit; John Nickerson and Sylvan Oestreich, New York; Ira A. Moore, Clark and Anderson, Grand Rapids.

36,430 Motorboat Gain In 1940 Registration

During 1940 the number of motorboats registered for use on Federal waters increased by 36,430 to 315,277, again of 13 per cent, according to a recent release by the National Association of Engine and Boat Manufacturers. The largest proportional gains were registered at ports on inland waters. Boat registrations at ports on the Great Lakes and other inland lakes increased 18 per cent, and activity on inland rivers was demonstrated by a 13 per cent boost. On the Pacific Coast the increase was 13 per cent; 12 per cent along the Gulf of Mexico, 7 per cent along the South Atlantic coast, and 7 per cent on the Eastern seaboard.

New York City remained the nation's most popular boating center, with an individual registration of 34,666 craft, but Seattle, Wash., displaced Baltimore, Md., as the country's No. 2 motor boat

GENERAL

Mass Production of Skilled Workers

Page

363

As the defense program goes on, new problems in filling the need for skilled men present themselves. Here is another article by E. L. Warner, Jr., showing what is being done; not alone for the immediate needs but for the future as well.

The Hotchkiss 12-Ton Tank

378

Opportunities to present the design details of any modern war machine are so scarce that this should be on your "must read" list. There are drawings and photographs that have been reproduced with the description.

PRODUCTION

Radial Engine Building

388

To learn the production routine and methods of turning out Diesel engines for the Army is a choice bit of reading that you will find in this article.

PISTON RINGS

Ring Width and Blow By

386

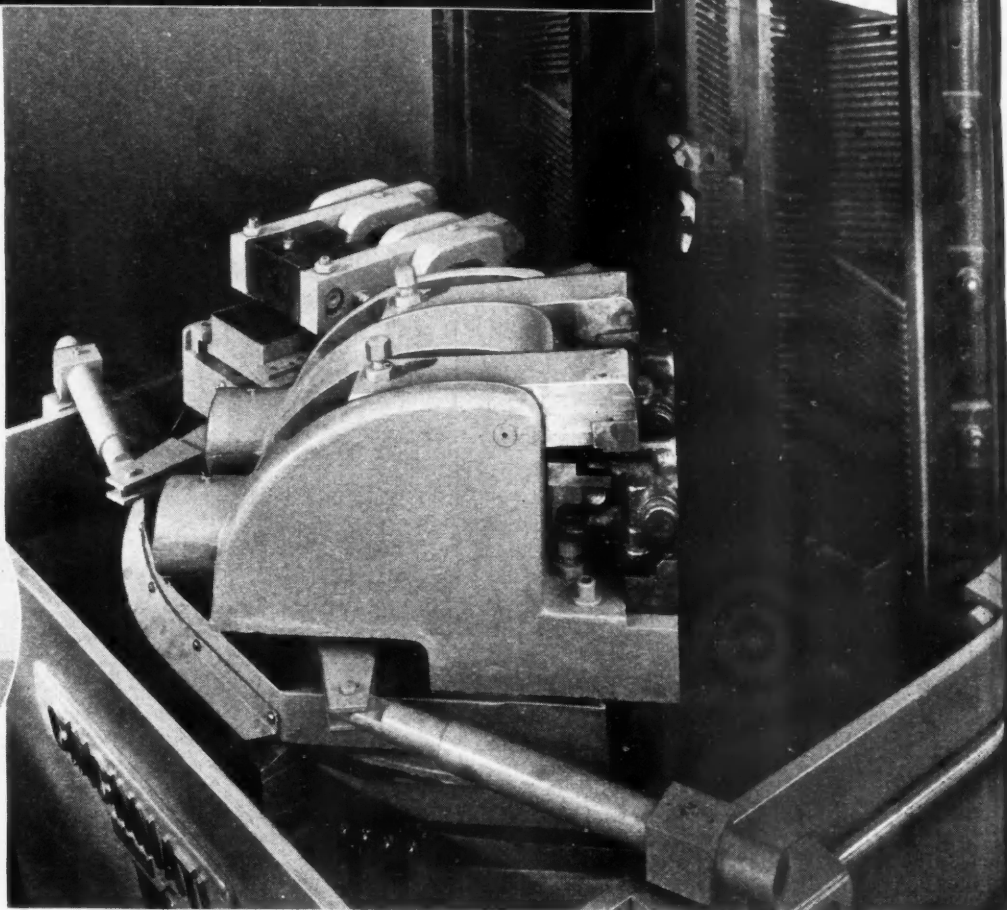
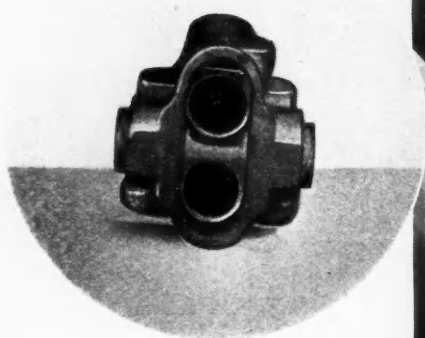
In this article the author has added considerably to the available data on compression rings. Not only in text but in graph form he develops the material gained from enlightening tests.

port. Seattle, during 1940, registered 18,913 craft, a gain of 2575, and Baltimore clung to third place with 17,561 registrations. Detroit, which was listed sixth at the start of 1940, jumped to fourth place, with 16,970 craft, a gain of 2718. Tampa, Fla., with 16,451 boats, replaced Philadelphia in fifth position. Norfolk, Va., jumped from tenth to ninth place, and Milwaukee, Wis., gained a berth among the leading 12 ports for the first time, usurping the position held last year by Portland, Me.

NADA Announces Dates For 25th Convention

Jan. 20-21, 1942, are the dates selected for the 25th annual convention of the National Automobile Dealers Association to be held in Chicago, the birthplace of the organization. Since the time also will mark the silver anniversary of the association, extensive plans are being made for an appropriate celebration.

IT NEVER GETS ARM WEARY



MANUALLY clamping and unclamping fixtures requires considerable effort—usually much more than the mere handling of the work. At a high rate of production, operators become arm-weary, slow down, spoil work. All this is eliminated with automatic clamping and releasing—a natural for CINCINNATI Duplex Hydro-Broach Machines.

Here you see an example of this labor saving and cost reducing feature. In swiveling from one station to the other, the swivel table—exclusively a CINCINNATI Duplex Hydro-Broach development—operates the jointed arms attached to the fixtures, automatically clamping and unclamping them.

PRODUCTION DATA

Machine—No. 10-66 CINCINNATI Duplex, fully equipped with broaching tools and fixtures by CINCINNATI Sales Engineers. Part—Shock absorber bodies. Operation—Broach cover and mounting pads. Production—584 parts per hour.

Of course, there are other CINCINNATI Hydro-Broach features of equal importance in over-all cost reduction of surface finished parts. Catalogs M-894 for the Duplex machines and M-886 for the Single Ram machines give you the whole story. Copies are yours for the asking.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI GRINDERS INCORPORATED

Manufacturers of

Tool Room and Manufacturing Milling Machines

Surface Broaching Machines

Centertype Grinding Machines

Cutter Sharpening Machines

Centerless Grinding Machines

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Published on the 1st
and 15th of the month

Vol. 84, No. 7
April 1, 1941

Mass Production of Skilled Workers

How the Automotive Industry is Meeting the Need for More Men for More Machines

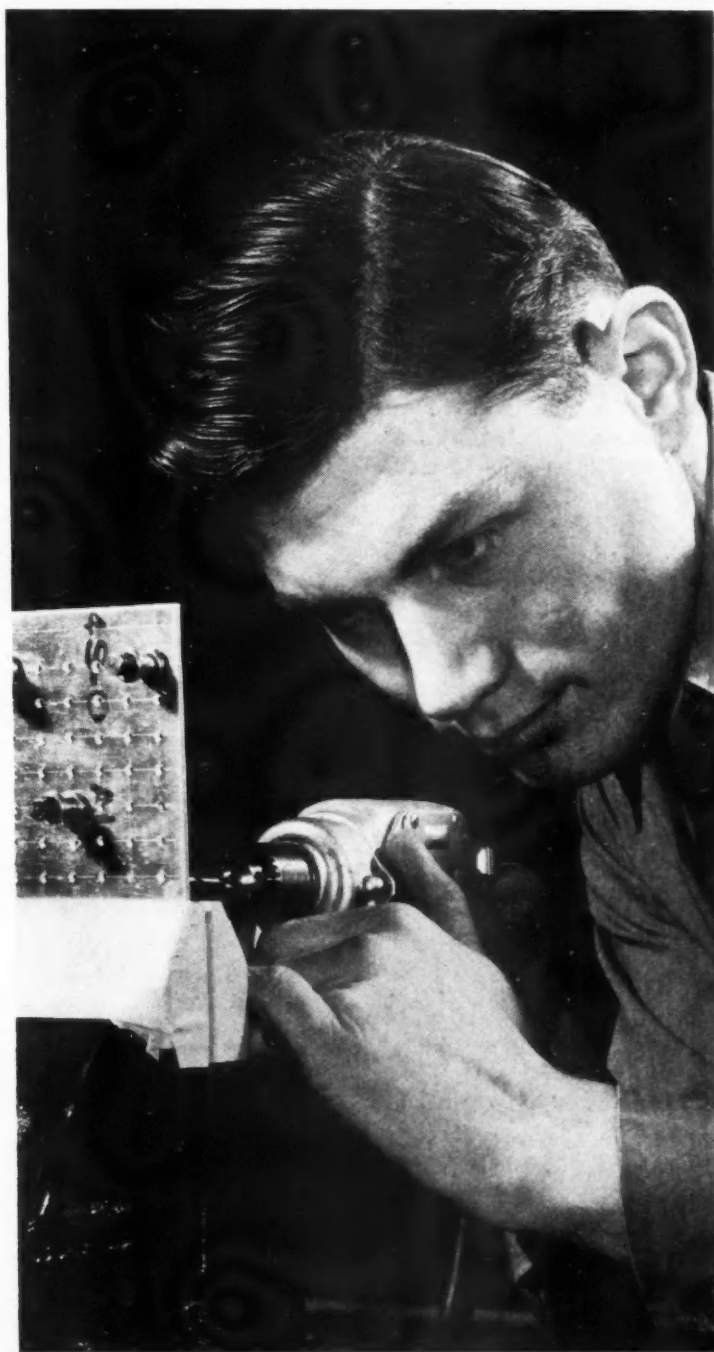
CONFRONTED with the greatest training job in their history, automobile manufacturers are busily engaged in converting vacant office and factory space into classrooms, and transforming experienced workers into instructors. Likewise, the aviation branch of the industry, which has expanded in 18 months from a relatively minor place in the U. S. industrial picture until it is the backbone of the rearmament effort, faces the task of adding more and more employees in the ever increasing demand for planes.

The problem is twofold: the breaking in of new workers with no industrial experience and the teaching of new skills and techniques to veteran craftsmen. Automotive companies are shifting workers to new plants manufacturing aircraft engines, airframes, tanks, machine guns and ammunition components. Aviation companies are upgrading skilled workers rapidly in their vast expansion programs in order to make room for inexperienced men to fill the simpler routine jobs.

John Haien, director of the educational program for the Chrysler Corp., states the automotive company case simply when he says, "Our problem isn't one of making skilled mechanics. We already have those. It's simply a matter of teaching our men new techniques, of giving them a diversity of skills."

This is the second of two articles by Mr. Warner on Training for National Defense.

Automotive Industries



This graduate of Chrysler's Junior Craftsmen is now employed in the Highland Park plant. In his spare time he is preparing for a place in the new aircraft division.

GENERAL

April 1, 1941

Chrysler is confronted with that problem in two directions. In its new tank arsenal under construction just outside Detroit, Chrysler will build 25-ton tanks for the army. Automotive assembly methods must be readapted for this purpose, because the production workers will be putting together a 50,000-lb. monster rather than a 3500-lb. motor car. Larger castings must be handled and more complex transmissions must be installed. But many of the general assembly principles are similar, so automotive workers can be taught at least half the work in a short time.

At the other extreme, Chrysler is expected to build fuselage parts for the Martin B-26 bomber. In airframe assembly, the men will be working with aluminum alloys, which are approximately one-third the weight of steel. Automotive workers, accustomed to steel, must be taught the technique of handling aluminum, which requires more care due to its tendency to scratch or corrode easily. A new attitude toward the medium in which they are working must be inculcated in the automotive employees. Airframe assembly work is more exacting, with more rigid inspection standards. It is a matter of hand skill rather than machine skill.

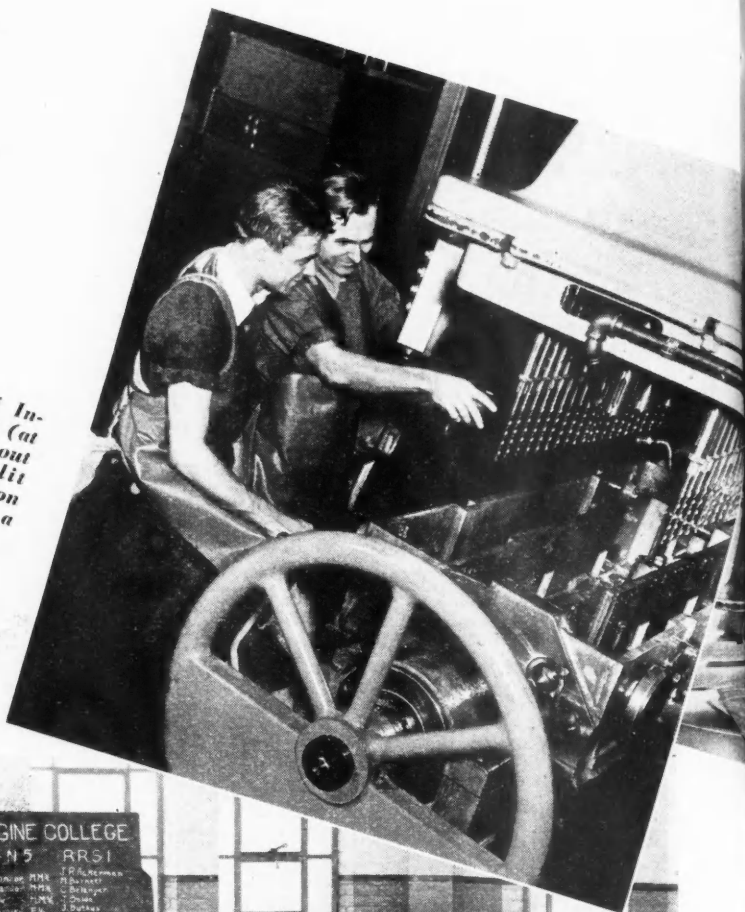
Thoroughness, conscientiousness and the instinct of good workmanship are the three prime requisites in this type of work, according to Haien. The men must be taught the behavior of metals. In aircraft assembly, there are 21 types of rivets and each type may be used hot or cold. A medium bomber may re-

quire 200,000 rivets, so the need for thoroughness and conscientiousness on the part of the worker is self-evident.

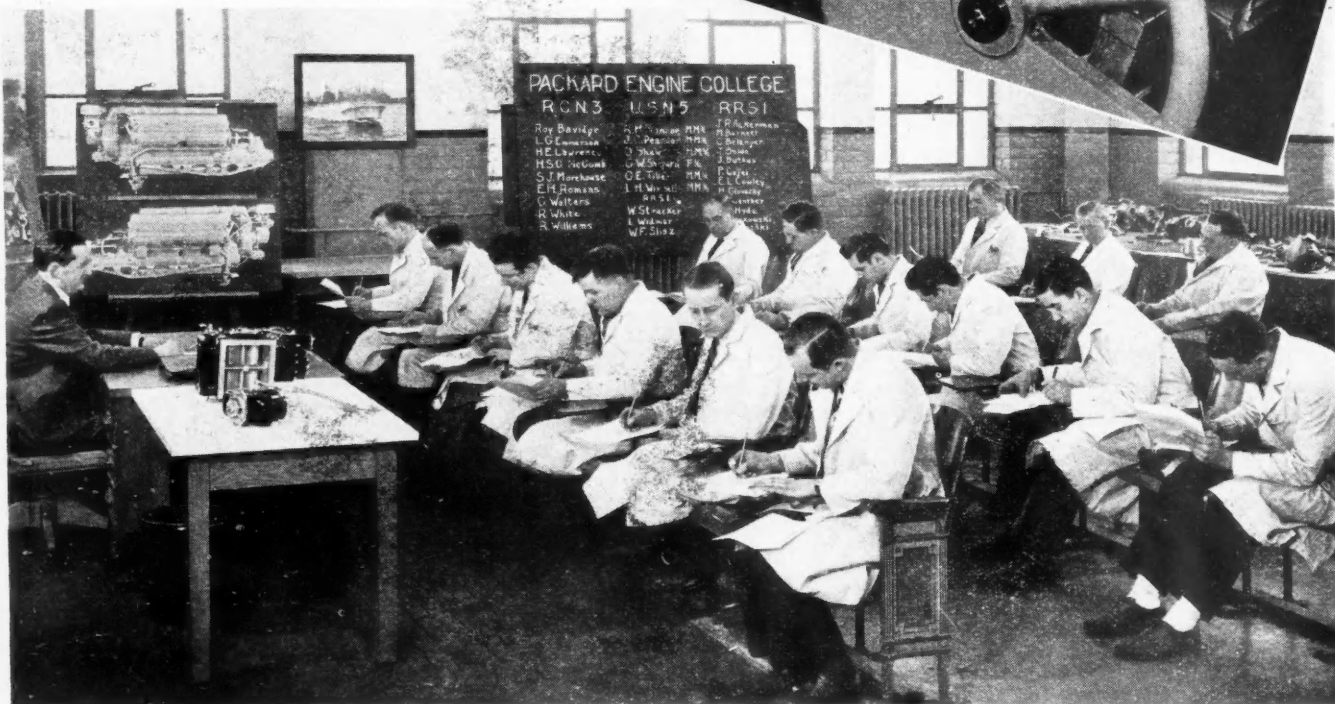
The problem of manpower confronting the aircraft industry is better understood when it is realized that from employment of 35,000 men two years ago it has mushroomed to a vast industry of more than 200,000 workers. When the peak is attained in early 1942, it is expected that 500,000 employes will be filling aircraft jobs. The supply of experienced men has long since been exhausted.

There are more than 200 types of trades in aviation,

A graduate of Indianapolis Tech (at left) learns about drilling the split line of an Allison engine from a skilled operator.



A class at the Packard Engine College. Packard mechanics and Navy men are getting advanced work on the marine engine.



The Ford Trade School is equipped with machinery worth \$2,000,000. Students turn out products for use, not exercise pieces good only for the scrap pile.

(Below) A master craftsman in the making is this advanced student in the Ford Trade School.



so the specialized training necessary is tremendous. The old qualifications were for two to four years of technical training for many of the jobs, but this has had to be greatly modified in the defense emergency. It is now possible to carry out the program with 80 per cent of the working force learning their jobs in six weeks to four months. New methods and special tools have been developed in the last year to make this possible, even though mass production in the automotive sense has been deemed unfeasible because plane designs cannot be "frozen" long enough. Improvements constantly must be made to meet and excel the improvements of the enemy if a nation is to maintain supremacy in the air. Three hundred planes is considered a minimum contract for employment of rapid

production methods.

Curtiss Aeroplane Division of Curtiss-Wright Corp., one of the largest producers of fighting planes in the country, has had to meet the demands of the national defense program with a virtually continuous expansion for the last year and a half. From employment of 2800 workers at its Buffalo plant in September, 1939, the total has grown to more than 10,000 men and will reach a peak of 40,000 next January. Eighty new men are being employed every day in the Curtiss Buffalo plant and 25 are enrolling daily in the school at the same plant.

Curtiss employs both training on the job and in a vestibule school, according to Charles S. Mattoon, the personnel director. In training for sheet metal fabrication, which requires largely hand skills, several hundred experienced men are selected in the plant and two or three semi-skilled men with mechanical experience are assigned to each. The instructors carry on their own work simultaneously with their breaking in of the new men to the complicated operations in which they are engaged. The semi-skilled men take over the operations in a few weeks.

All new Curtiss workers lacking experience go through the vestibule schools, maintained in Curtiss plants at Buffalo, St. Louis and Columbus, Ohio, each with an enrollment of 800 students. The school course lasts four to six weeks and includes classes in tube bending, acetylene welding, sheet metal fabrication, blueprint reading and preliminary use of machine tools. Trainees are drilled in the use of precision instruments and attend lectures on the techniques to be employed. There is constant repetition of the elements

of each operation. To learn the various types and sizes of rivets, trainees may spend two to three hours daily in selecting rivets out of a bushel basket.

A factory rather than a school atmosphere is maintained in the classes, with factory discipline prevailing. Students are given instruction in factory regulations and safety practices. Their work is inspected constantly to stress the necessity of careful workmanship. All school applicants go through the regular employment procedure. Instructors are drawn from the ranks of old employees. The first school was established at Buffalo in January, 1940. Of the first 1000 to enroll in the school, only 13 failed in the instruction or later employment. Intelligence and mechanical aptitude tests help eliminate the unfit applicants.

Curtiss also has an engineering training program in which 400 are enrolled at Buffalo to develop technical men for higher skilled brackets. This embraces high school graduates who are taught draftsmanship, partially trained engineers with two years of college and the retraining of mechanical, civil and other type engineers for aeronautical engineering work. This phase of the Curtiss program is carried out with the cooperation of Cornell University engineering instructors, who come to Buffalo to teach the classes. Similar programs are being worked out for Curtiss plants at Columbus, in cooperation with Ohio State University, and at St. Louis with Washington University.

Lockheed Aircraft Corp. at Burbank, Cal., in the center of the California aircraft industry where employment has increased seven-fold in the last four years, launched a series of eleven 16-week extension training classes in 1937 in cooperation with the Burbank public schools. At present 4500 Lockheed employees are enrolled in 135 extension classes, which run for five months. Several thousand more have graduated from these classes, which are held both in the public schools and the factory. Engineering trainees attend for a longer period, with riveters, template makers, sheet metal workers and blue print filers who have the necessary scholastic background taking a year's class-

room work in order to qualify as higher paid engineers.

Murray Corp. of America, one of the first automotive companies to go into airframe fabrication, has set up a training school occupying 25,000 sq. ft. at one of its Detroit plants. It is under the direction of Russ Frazer, a former Douglas Aircraft Corp. employee. He has patterned it after the program developed at two California technical schools, Frank Wiggins Trade School in Los Angeles, and Santa Monica Tech. With a subcontract for \$30,000,000 from Douglas for bomber wing subassemblies, Murray will employ about 5500 men in its new aircraft division.

Frazer plans an eight-week general course, combining one-third classroom study with two-thirds shop

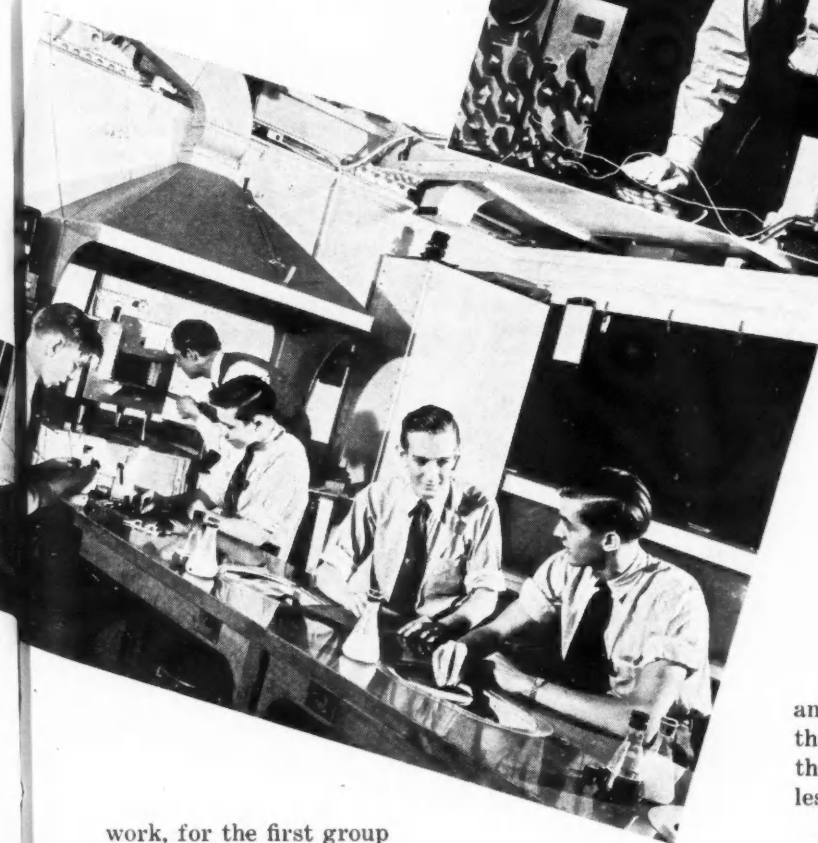
These citizens of "Boys' Town" at Cadillac are started on their careers as skilled workers by learning hand polishing methods on Allison engine propeller shafts.



Future "set-up" men. They will have charge of small groups of operators in the new machine gun plant of the AC Spark Plug Co. in Flint.

Instruction in the use of the cathode ray oscillograph at the General Motors Institute. G. M. estimates that it will need 60,000 workers, including hundreds of highly trained technicians, to complete its defense orders.

(Below) Students in the metallurgy laboratory of the Ford Trade School preparing samples of metals for tests.



school will open this month with an initial enrollment of 100 pre-employment trainees and will add 30 per day after that until a peak enrollment of 1300 is reached, divided into three eight-hour shifts. There will be approximately 24 men to each instructor and each individual will be advanced to

another phase of the training program as he shows that he has mastered that particular type of skill. Thus the more rapid learners may go through the school in less time than the eight-week standard.

Power is required to drive the airplanes that Curtiss, Lockheed, Douglas and the other companies are building, so that is where the aircraft engine manufacturers enter the picture. The Ford Motor Co., which has an initial order for 4236 Pratt & Whitney 2000-hp. engines, is one of the best equipped of the automotive companies to branch out in this kindred field. Ford has maintained an apprentice school for 25 years, during which it has turned out 7000 skilled and semi-skilled workers, of whom 3100 still are working in the Rouge Plant. So the Henry Ford Trade School has been entrusted with the task of training the bulk of the 9000 workers who eventually will work in the new aircraft engine building just nearing completion. Twenty thousand sq. ft. in the front of this building have been set aside for the aircraft apprentice school.

Frederick E. Searle, superintendent of the Ford industrial schools, does not anticipate any difficulty in getting experienced manpower for the more skilled

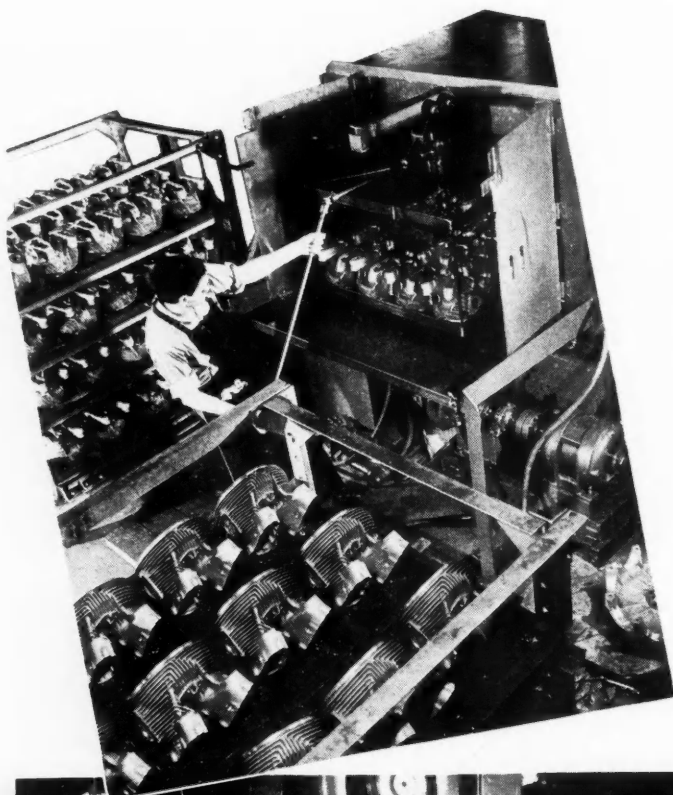
(Turn to page 400, please)

work, for the first group of production trainees. The classroom work will cover blueprints, aluminum alloys, stainless steel, types of corrosion and processing. After a working force is established for airframe manufacture, future trainees will undergo a shortened two-week course in which they will specialize in one operation repetitive in nature, following which they will be placed in the plant to acquire additional knowledge and skill on the job.

Airframe manufacture breaks down roughly into three parts. The development work calls for measuring and marking of the material and requires about 10 per cent of the personnel. Bench fabrication, in which the parts are numbered, drilled, cut, formed and filed, takes another 15 per cent, while assembly constitutes 75 per cent of the job and thus calls for the most workers.

Murray is endeavoring to hire semi-skilled workers selected through intelligence and aptitude tests. The

Radial



design, featuring one-story construction, entirely windowless, with fluorescent lighting, and with a special pressure ventilating system which keeps the working area dust-free.

During the past few months, the pressure of National Defense requirements has strained the facilities of the present plant, so that possibly another plant will be erected later.

It is of interest to note that the "Radial Engine Building," as it is called, is a completely self-contained operation—from the raw materials to the machine shops, inspection, assembly, testing, and shipping.

Niagara washing machine with a special rotatable fixture is used for miscellaneous metal washing operations. This shows the unloading of cleaned cylinder heads.

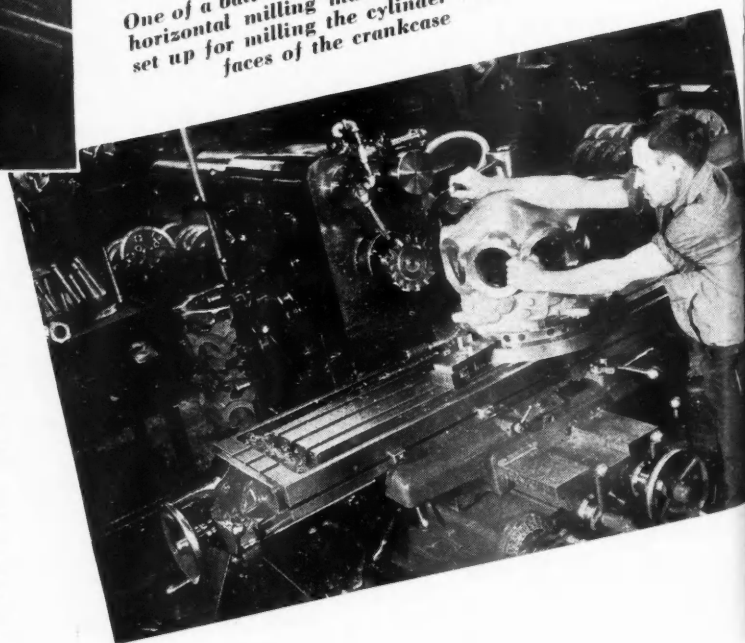
Moreover, as will be evident later, the production equipment represents items of machinery which are entirely new, and, in other instances, are the latest examples of their kind.

Since the Guiberson engine is substantially interchangeable both for tanks and aircraft, aircraft precision practice prevails in every detail, with 100 per cent quality control. Precision begins



Close-up of the big Fay automatic lathe tooled for finishing the cylinder barrel in one setting.

One of a battery of Kearney & Trecker horizontal milling machines, this one set up for milling the cylinder contact faces of the crankcase



THE ONLY American-built radial air-cooled Diesel engine that flies—the Buda-Guiberson—has been impressed for use in U. S. Army tanks in the National Defense Program. Developed by the Guibersons in Dallas, Tex., this unique light-weight engine is being produced by The Buda Company in a new plant built on its property in Harvey, Ill.

Constituting an important contribution to National Defense, the engine owes its precision-built quality to the marvelous manufacturing facilities made available last year, representing an investment in excess of \$1,000,000. The building follows the pattern of advanced

Engine Building

at the Buda-Guiberson plant has developed machines that are new and methods that are unique

with the protection afforded by the special ventilating system which maintains a positive pressure of about 1 lb. above atmospheric pressure, thereby providing a seal against the entry of dust or dirt so necessary to fine finishing operations. Precision is maintained in the machine shops through the use of precision machinery, precision fixtures, and advanced methods of quality control.

To further safeguard precision, the new equipment is reserved exclusively for finishing operations, all roughing operations being performed on older machines.

Coming to the details of quality control, it may be noted that the maintenance of quality standards is assured by a system of 100 per cent process inspection by a corps of inspectors assigned to the machine shop departments. All finished parts clear through the central inspection department where they are OK'ed and sent through to central stores. The latter department is the key to quality control since all

parts that go into a sub-assembly and finally into a finished engine must be drawn from the stock room.

These rigid safeguards also extend to raw materials. All incoming raw materials are received through one door only, and are subjected to 100 per cent inspection before being routed to the machine shops.

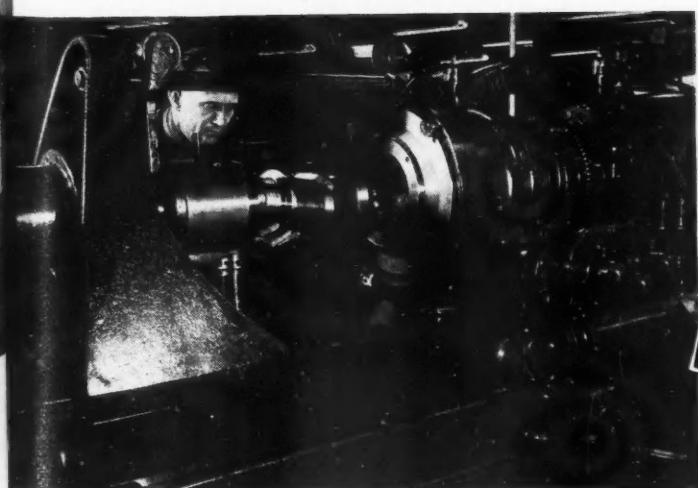
General Layout

The building proper extends 350 ft. in length, east and west, with the machine shop section dominating the structure. At the rear end, the inspection depart-

This is the Fifty-eighth in the series of monthly production features

One of the two Hall Planetary milling machines found in the Radial building. The operator is loading a cylinder barrel for cutting the thread which mates with the thread in the cylinder head.

Cylinder barrels are honed on this Barnes Drill Co. precision honing machine, fitted with Micromatic, hydraulically operated tools. A special tilting fixture is employed, permitting the operator to check the work.



PRODUCTION

Factory Routing of Crankcase, Rear

OPERATION AND EQUIPMENT

FACE and TURN front crankcase **FIT, FACE and BORE** ball race hole
Bullard V-T-L

FACE and BORE accessory case fit, cut oil grooves and scaling grooves
Bullard V-T-L

DRILL (9) 13/32 in. and 18 holes for 5/16—18 tap in accessory contact face
Natco multiple spindle drill press

SPOTFACE (9) 13/32 in. holes

DRILL, REAM and SPOTFACE 0.874 in. throttle lever hole, **COUNTERBORE and CHAMFER** 1/16 in.—45 deg.
American radial drill

ASSEMBLE front to rear case and **DRILL and REAM** (9)—0.375 in. holes and **NUMBER** cases
Natco multiple spindle drill

BACKFACE 9 holes in 14 Y 56 rear case

BOLT front and rear case together

ROUGH and FINISH MILL 9 cylinder contacts and **ROUGH and FINISH BORE** cylinder bores
Hall Planetary mill

MILL oil sump pads on both cases
Kearney & Trecker milling machine

MILL 18 push rod pads
Kearney & Trecker milling machine

MILL 9 fuel pump pads
Kearney & Trecker milling machine

DRILL, REAM, CHAMFER 18 push rod holes and **DRILL, COUNTERBORE, CHAMFER and REAM** 9 pump holes
American radial drill

MILL steady rest pad on 14 Y 40 case
Kearney & Trecker milling machine

BORE and REAM 2-in. holes in steady pad on 14 Y 40
American radial drill

OPERATION AND EQUIPMENT

MILL flat for clearance on 2-in. hole on steady rest pad on 14 Y 40 case
Kearney & Trecker milling machine

DRILL 8 holes 15/16 in. deep for 3/8—16 tap for bearing seal cover on 14 Y 40 case
Natco multiple spindle drill

DRILL (108) 23/64 in. holes for 7/16—14—tap for cylinder hold down studs in 14 Y 56 and 14 Y 40
Natco multiple spindle drill

DRILL, CHAMFER 18 holes in push rod pads and 18 holes in fuel pump pad in 14 Y 56 case
American radial drill

DRILL main angle oil lines **DRILL and TAP** (4) 1/4 in. pipe plug holes and **DRILL** 4 holes in oil sump pads
American radial drill

DRILL 4 holes for throttle control
American radial drill

DRILL 10 angle oil holes in push rod holes in 14 Y 56

DISASSEMBLE cases

FINISH single blade **REAM** push rod and fuel pump holes in 14 Y 56 case

TAP all holes in 14 Y 56 & 14 Y 40 case
Bakewell tapping machines

REMOVE all burrs, **DRILL** drain holes and all hydraulic lock holes

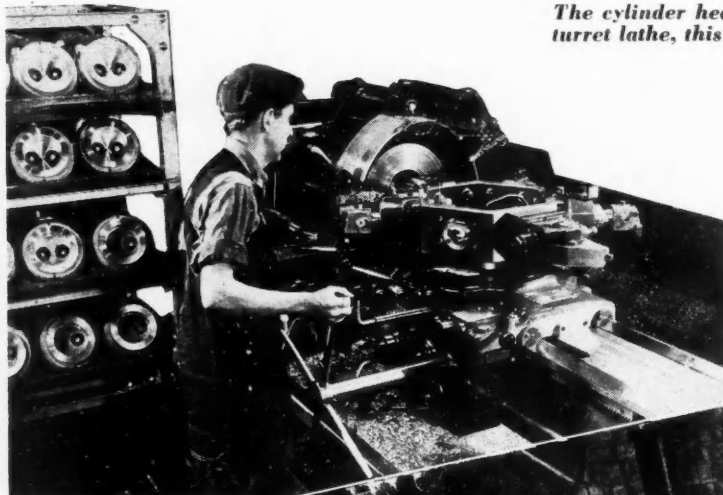
ASSEMBLE bearing liners to both halves and **DRILL** and **PIN** liners in place

LOAD 14 Y 56 to grinder and grind big liner
Bryant internal grinder

ASSEMBLE 14 Y 40 to 14 Y 56 on grinder and **GRIND** 2 bearing liners
Bryant internal grinder

WASH both halves and **DELIVER** to inspection

ASSEMBLE with studs, etc., 14 Y 56 and 14 Y 40

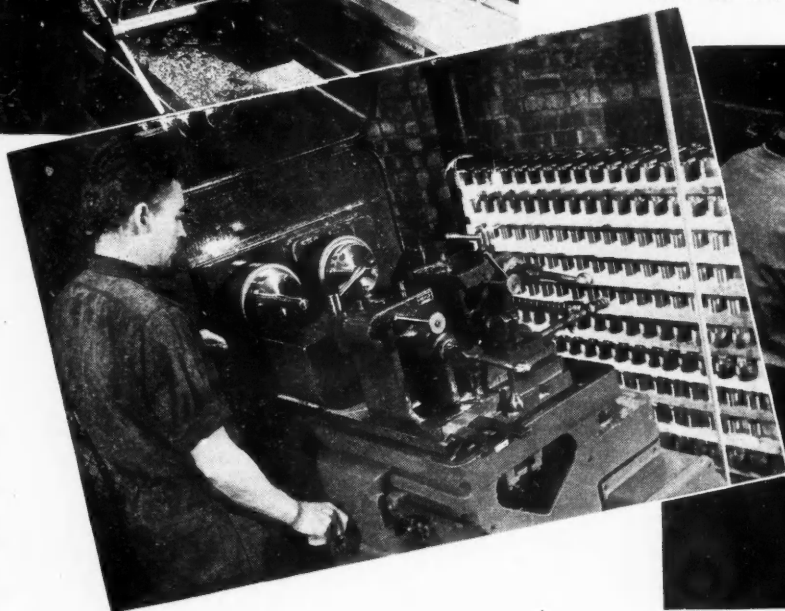


The cylinder head is machined on a Cincinnati-Acme turret lathe, this view showing the doming operations.

ment and finished stores occupy the north-eastern corner directly in line with the machine shop area. The extreme south corner of the building is a section approximately 100 x 170 ft., which houses all of the

Finishing operations on the inside bore of the rear section of the crankshaft are handled on this Jones & Lamson turret lathe.

Here is a close-up of one of the two Heald Borematic precision boring machines on connecting rods. This machine takes care of the link rods.



April 1, 1941

Automotive Industries

sub-assembly and final engine assembly operations.

Paralleling the machine shops, starting with the west end of the building, is a block of six final test cells, terminating in the engine trim and shipping department.

In general, the production equipment is of universal or general purpose character, arranged in three parallel rows. And in keeping with the rather moderate volume of production, no attempt has been made to departmentalize the activity, a variety of parts being routed over the same machines in many instances. This procedure is facilitated by the use of interchangeable fixtures and tooling which makes it possible to effect a quick changeover from one part to another.

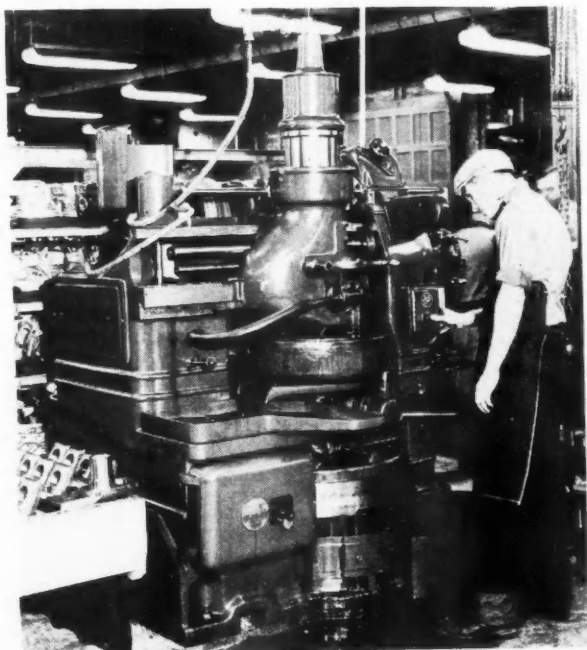
This philosophy of operation follows naturally from the principles employed by Buda for many years. For further evidence of this, the reader is referred to an

earlier study of Buda manufacturing procedures, published in *AUTOMOTIVE INDUSTRIES*, Jan. 1, 1938.

As to examples of the universal types of equipment used here, we may refer to the battery of American radial drills, the J & L turret lathes, Acme turret lathes, Landis and Norton grinders, Bullard V-T-L machines, Bakewell precision tappers, Avey sensitive drills, American Pacemaker lathes, and the Fellows gear shaper.

While we are on the general subject of production equipment, it is important to observe that since rigidity and freedom from vibration are essential elements in precision work, the selection of machines deliberately represents sizes which are usually considerably in excess of the minimum rating for a given job. Just to cite a few cases, we can point to the massive radial drills, the huge Norton grinder used for grinding cranks and cylinder barrels, the latest editions of the big Bryant chucking grinders, the sturdy K & T milling machines.

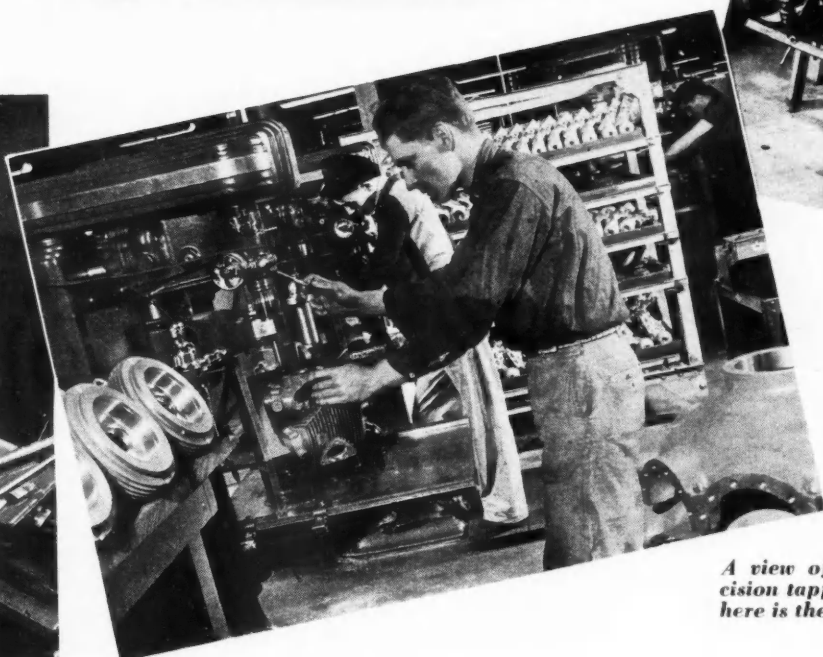
Another feature of interest is the Blakeslee Niagara washing machine which is used for cleaning the ma-



Here is an interesting balancing machine developed for the crankshaft. All there is to it is the Delta drill head and the static-balance fixture shown on the table.



Typical sub-assembly operations—head and barrel assembly—is seen here. At the left is the furnace in which the cylinder heads are heated to a temperature of 500 deg. Fahr., prior to the assembly operation.



A view of the battery of Bakewell precision tapping machines. Operation shown here is the tapping of holes in the cylinder head.

jority of the machined parts prior to assembly. The washer is fitted with a bank of vertical and horizontal nozzles, has a rotatable fixture for the parts containers, assuring a penetration of the washing solution to every part of container.

Machine Shop Detail

Consider now the manufacturing procedures on a group of major parts. First in order is the cylinder head which is made of Y-metal alloy. The sequence of operations is as follows:

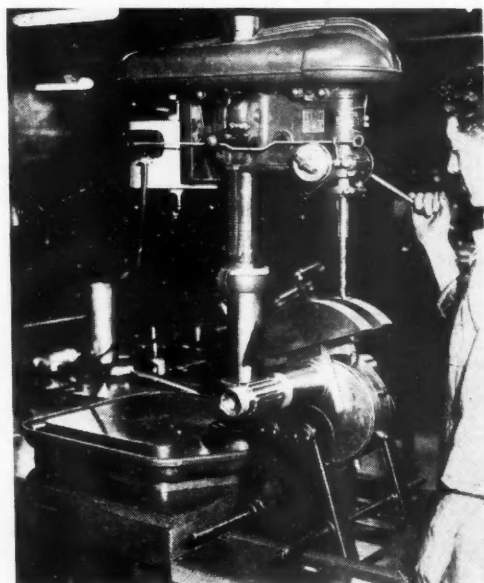
Rough face and bore on an Acme turret lathe, using Carboloy tools
Turn and face locating pilot on a J & L turret lathe
Bore for thread and combustion chamber and polish—on same machine
Mill rocker arm slot on K & T Milwaukee mill
Mill rocker arm box face—same machine
Drill, ream, and bore valve guide holes, c'bore for valve inserts on American Radial
Mill intake and exhaust port pads on K & T milling machine
Mill injector face on K & T milling machine
Series of drilling, reaming, spotfacing, etc., on American Radial drills
Drill 12 holes in rocker box cover contacts on Natco multiple drill
Four different tapping sequences on the Bakewell precision tapping machines
Mill thread on inside of head, for cylinder barrel, on the Hall Planetary
Remove burrs, clean and blow off, inspect

It may be noted that the Bakewell precision tapping machines used in the foregoing are equipped with a special lead screw for each different thread, making the operation fool-proof and independent of the operator's skill. The Hall Planetary mill used for cutting the thread also is used for machining the nine crankcase faces and bores, as will be noted later.

Another example is the routing for the machining and sub-assembly of the cylinder barrel. First operation is that of rough turning the outside diameters, turning and facing the flange—on J & L turret lathe. This is followed by a boring operation on a massive

Gisholt turret lathe, finishing from the rough in one pass of the big boring bar. Boring is done with a single lathe tool tipped with Carboloy. The bore is semi-finish ground on a Bryant internal grinder, then routed to the battery of two Fay automatic lathes. On the first of these, all diameters and faces are rough-turned; on the second, the fins are rough- and finish-formed.

The barrel then goes to the huge Norton external grinder which is fitted with a special wheel for finish grinding the two principal outside diameters. The same grinder, with a change of wheels, is used for crankshaft grinding. Next the thread for the cylinder head is milled on a Hall Planetary which is set up for cylinder barrels exclusively.

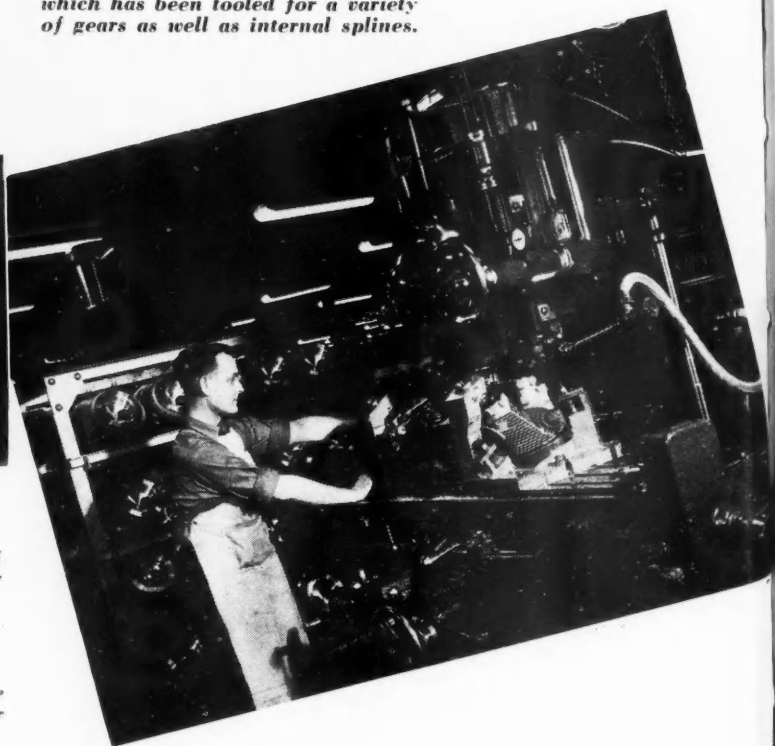


Close-up of new Fellows gear shaper which has been tooled for a variety of gears as well as internal splines.



Huge Norton cylindrical grinder is used for the grinding of crankshafts. Operation shown here is that of finish-grinding pins on the main crankshaft section.

One of the jobs handled on this No. 4 Vertical Milwaukee mill is that of milling the rocker box face on the cylinder head.



The cylinder bore is corrected again by a semi-finish grind on a Bryant internal grinder which holds the bore to 5.124 plus 0.0005 in., minus 0.000 in. This is followed by a single honing operation on a Barnes Drill Co. honing machine fitted with a special fixture and a Micromatic hone.

The Barnes Drill Co. 306-H single-spindle honing machine is arranged with air counterbalance mechanism, dwell, and special variable speed motor drive. An electric control panel mounted on the side of the machine provides push button control of reciprocation, coolant, machine cycle, and variation in spindle speeds in the range from 50 to 200 r.p.m. An interesting feature of the work fixture is its trunnion type construction, permitting the inspection and gaging of the work in process by tilting the fixture. A counterbalance weight facilitates the tilting operation.

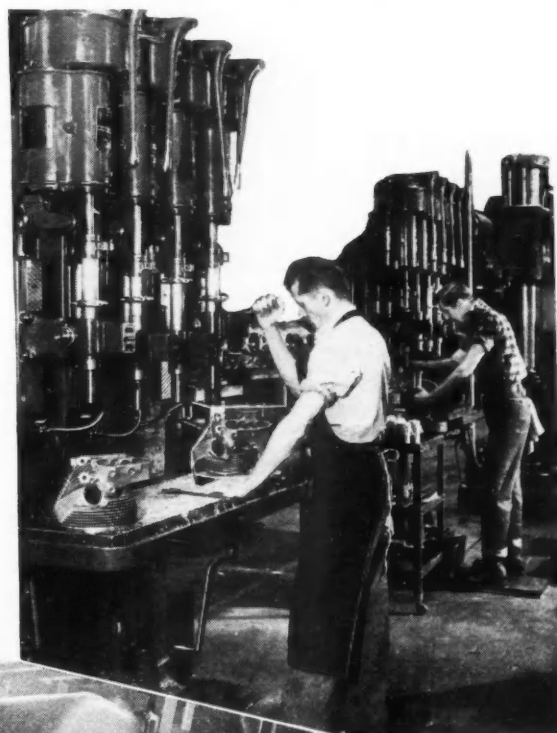
Before the final operations are performed, the barrel and cylinder head are assembled into a unit at the sub-assembly bench. For this operation, the cylinder heads are expanded by heating in a long conveyor type oven in which the part is heated to a temperature of 450-500 deg. Fahr.

The 12 flange holes now are drilled in the Natco multiple drill, backmilled on a radial drill, and burred. Two flats are milled in the flange on a K & T miller, and burred. The barrels are cadmium plated as the

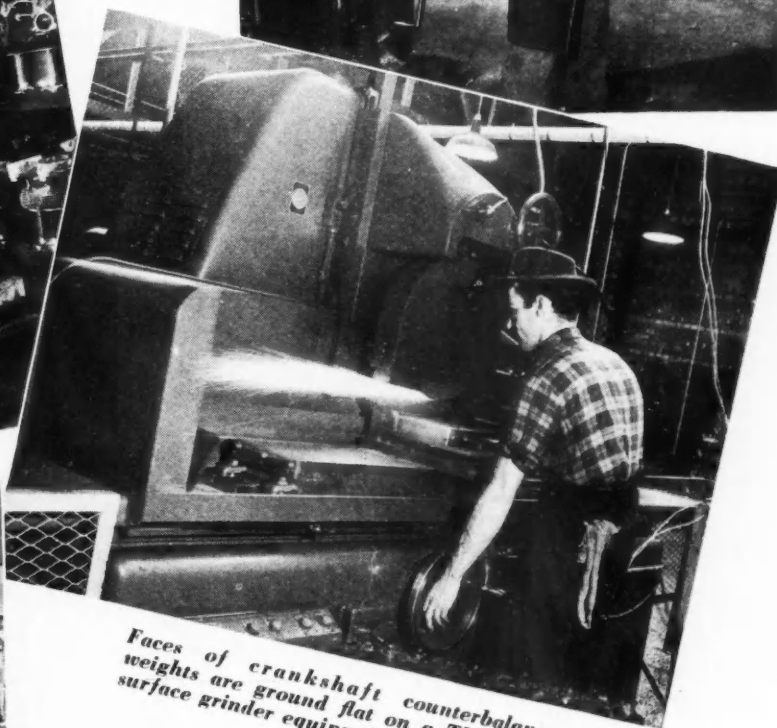
final operation, inspected, and made ready for final assembly.

The crankcase is made up of a front and a rear sec-

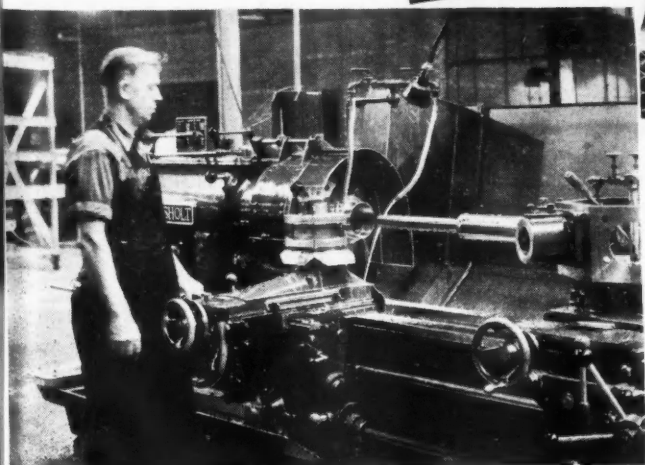
A battery of two, four-spindle Motor Avey sensitive drilling machines, featuring hydraulic feed with electric control. The machine in the background is performing back-facing operations on exhaust elbows, while the one in the foreground is drilling holes in the rocker box face of cylinder heads.



Preparing for final engine assembly. This operator is installing push rod housing nipples in the cylinder head.



Faces of crankshaft counterbalance weights are ground flat on a Thompson surface grinder equipped with a magnetic table.



Close-up of Gisholt heavy-duty turret lathe used for boring the Guiberson cylinder barrel.

Factory Routing of

OPERATION AND MAINTENANCE

FACE large line bearing shoulder to gage, **ROUGH TURN** large line bearing to 3.360 in. and small line bearing to 2.835 in. **TURN** center stub to 1 in. dimension
American Pacemaker engine lathe
GRIND large line bearing diameter to 3.335 in. and small end to 2.810 in. back 1½ in. from end of crankshaft
Landis external grinder
ROUGH MILL inside face of crank cheek locating from line bearing
Kearney & Trecker milling machine
CENTER crank pin
American radial drill
FACE cheek on pin side and **ROUGH TURN** crank pin to 2.520 in. **FORM** fillet and **FACE** end of pin to dimension
Wickes crank pin lathe
STRADDLE mill edges of crank cheek to 4.000 in. dimension
Kearney & Trecker milling machine
STAMP heat number in location shown on print
PROFILE MILL 2.000 in. radius on pin end of crank cheek
Kearney & Trecker vertical mill
ROUGH MILL bottom end of crank cheek to 8% in. dimension
Kearney & Trecker milling machine
ROUGH FORM outside face of crank cheek
Hendee Norton milling machine
ROUGH MILL 30-degree angle on pin end of crank cheek
Kearney & Trecker milling machine
NORMALIZE to specification
CLEAN out centers, both ends of crank, use hand tool
ROUGH TURN large line bearing to 3.300 in. and small end of shaft to 2.750 in. and **FACE** shoulder to 1-9/16 in.
American engine lathe
GRIND large line bearing diameter to 3.275 in. and small end of shaft to 2.725 in.—1½ in. back from end of shaft
Norton external grinder
TURN crank pin to 2.450 in. and **FACE** end of pin
Wickes crank pin lathe
GRIND crank pin to 2.415 in.
Landis grinder
DRILL and **COUNTERSINK** ¼ in. hole for oil tip and **DRILL** 3/16 in. hole opposite oil tip hole
American radial drill
BURR and **FILE** all sharp edges
Copper **PLATE** all surfaces except crank pin as specified.
Use collar to tape
CARBURIZE, HARDEN and **DRAW** per specifications
DESCALE at outside source—heat treating
DRILL out old center in crank cheek and recenter locating from crank pin
American radial drill
TURN large diameter on line bearing to 3.200 in. and

OPERATION AND MAINTENANCE

small end to 2.642 in. and **FACE** shoulder
American engine lathe
GRIND large diameter on line bearing to 3.175 in. and small end to 2.600 in.—1½ in. back from end of shaft
Norton grinder
CUT OFF center stub and **FACE** end of shaft to 12% in. dimension
American engine lathe
DRILL, ROUGH and **FINISH REAM** ⅝ in. hole, tapered hole and 17/16 in. hole and form chamfer in shaft from crank cheek
Gisholt turret lathe
DRILL, ROUGH and **FINISH REAM** tapered hole in opposite end of shaft and form chamfer
Steinle lathe
FACE inside of crank cheek making dimension "C" 1.390 in. and form 3 in. shoulder on crank pin
Wickes crank pin lathe
GRIND inside of crank cheek to remove tool marks making dimension "D" 1.375 in.
Landis grinder
FINISH GRIND 2.374 in. pin diameter and **GRIND** 0.160-0.180 in. radius
Norton grinder
FINISH GRIND 2.3125 in. diameter at end of crank pin
Landis grinder
DRILL, REAM, COUNTERBORE, TAP and **COUNTER-SINK** hole in crank pin
American radial drill
DRILL ¼ in. hole and 3/32 in. hole in end of crank pin, **COUNTERBORE** 1 hole 7/32 in. diameter x 3/16 in. deep
American radial drill
MILL 25/64 in. radius for clamp bolt
Kearney & Trecker milling machine
MILL keyway
Kearney & Trecker milling machine
ASSEMBLE 14 Y 3 (rear) to 14 Y 1 (front) according to gage and dimension 3.250 in. and **ELECTRIC ETCH** mating number on each unit in location shown on drawing
LOCATE from large line bearing diameter on 14 Y 1 (front) and **FINISH BORE** 3 diameters internally in 14 Y 2 (rear) **RECENTER** and **UNDERCUT** 2.010 in.
American engine lathe
TURN small diameter on 14 Y 2 (rear) to 2.779 in.
American engine lathe
STRADDLE mill edges of crank cheeks on 14 Y 1 (front) and 14 Y 2 (rear) to 2.770 in.
Kearney & Trecker milling machine
GRIND edges of crank cheeks on 14 Y 1 (front) and 14 Y 2 (rear) to 3.750 in.
Thompson surface grinder
FINISH MILL 30-degree angle on crank cheek at crank pin on 14 Y 1 (front) to gage
Kearney & Trecker milling machine
TURN small end of 14 Y 1 (front) to 2.337 in. and **LINE** bearing diameter on 14 Y 2 (rear) to 3.175 in., **SPACE**

tion. As will be noted, the initial operations on each section of the case are performed on a Bullard V-T-L machine. High-speed-steel tools are employed for roughing; Carboly-tipped tools for finishing. The rough assembly of the two sections goes to the Hall Planetary, at the ninth operation, for the rough- and finish-milling of nine cylinder contact faces, finish-boring of the cylinder bores.

The crankshaft, which is composed of two separate sections and counterweighted, is completed with a ground and polished finish all over, and balanced statically. The routing marks a good example of the progress of work over a large variety of machines.

First operations, turning and facing, are handled

on one of the new American Pacemaker engine lathes which are semi-automatic in operation, fitted with a gear shift lever for quick speed changing. Note particularly the series of grinding operations on the Norton and Landis grinders, cheeking and pin turning on the Wickes lathe, turning on the engine lathe, before and after heat treatment. This progressive backtracking of major operations provides the necessary correction of the vital surfaces and dimensions, washing out the effects of intermediate operations.

The internal spline in the second section of the crankshaft is produced on the Fellows 6A gear shaper. This is a general purpose machine, also will be used for making some gears.

Crankshaft, Front

OPERATION AND MAINTENANCE

shoulders leaving 0.010 in. for finish grind on shoulders, **UNDERCUT** and **CHAMFER** crank complete, **FACE** end of 14 Y 1 (front) to 11.344 in.

American engine lathe

FINISH GRIND diameter of crankshaft complete to all finish dimensions

Norton grinder

DISASSEMBLE 14 Y 2 (rear) from 14 Y 1 (front) crank **ROUGH** and **FINISH MILL** spline on 14 Y 1 (front) crank; **REMOVE** burrs and **CHECK** to gage

Kearney & Trecker milling machine

PROFILE MILL $1\frac{1}{8}$ in. radius on 14 Y 1 (front) at crank pin end of cheek

Kearney & Trecker milling machine

FORM MILL outside face of crank cheek on 14 Y 1 (front) to 0.760 in.

Kearney & Trecker vertical mill

FINISH GRIND outside face of crank cheek on 14 Y 1 (front) to 0.750 in.

Thompson surface grinder

COUNTERBORE, **FORM** radius, **POLISH**, **DRILL** and **REAM** $37/64$ in. hole on inside of 14 Y 2 (rear) crank Jones & Lamson turret lathe

FINISH FORM MILL outside face of crank cheek on 14 Y 2 (rear)

Kearney & Trecker milling machine

FINISH GRIND outside face of crank cheek on 14 Y 2 (rear) to 0.750 in.

Thompson surface grinder

GRIND 3 internal diameters on 14 Y 2 (rear)

Bryant internal grinder

CUT spline internally on 14 Y 2 (rear), **REMOVE** all burrs and **CHECK** to gage

Fellows gear shaper

DRILL $3/16$ in. pin hole and **COUNTERSINK** in 14 Y 2 (rear)

American radial drill

DRILL $5/32$ in. oil hole in 14 Y 2 (rear) line bearing and **REMOVE** burrs.

American radial drill

FILE to remove all tool marks and sharp corners and fit counterweights on 14 Y 1 (front)

FILE to remove all tool marks and sharp corners and fit counterweights on 14 Y 2 (rear)

DRILL and **REAM** 6 holes in counter weight and crankshaft, 14 Y 1 (front)

American radial drill

DRILL and **REAM** 6 holes in counterweights and crankshaft 14 Y 2 (rear)

American radial drill

COUNTERSINK rivet holes in counterweights on 14 Y 1 (front) crank

American radial drill

COUNTERSINK rivet holes in counterweights on 14 Y 2 (rear) crank

American radial drill

PRESS rivets into crank and counterweights 14 Y 1 (front)

OPERATION AND MAINTENANCE

PRESS 6 rivets into crank and counterweights 14 Y 2 (rear)

HEAT and **RIVET** counterweight to crank on 14 Y 1 (front)

HEAT and **RIVET** counterweight to crank on 14 Y 2 (rear)

ASSEMBLE 14 Y 2 (rear) to 14 Y 1 (front) crankshaft according to gage and dimension 3.250 in.

ROUGH and **FINISH** turn radius on counterweights to 7 in. radius

American engine lathe

STRADDLE MILL counterweights to 1.905 in. dimension on 14 Y 1 (front) and 14 Y 2 (rear)

Kearney & Trecker milling machine

DISASSEMBLE crank 14 Y 2 (rear) from 14 Y 1 (front) use wedge furnished to spread slot in 14 Y 2 (rear) crank

FINISH GRIND both side faces of counterweights on 14 Y 1 (front) to 1.875 in. dimension

Thompson surface grinder

FINISH GRIND both side faces of counterweights on 14 Y 2 (rear) to 1.875 in. dimension

Thompson surface grinder

FILE $\frac{1}{4}$ in. radius at ends of counterweights, **FILE** to remove all sharp edges and **POLISH** 14 Y 1 (front)

FILE $\frac{1}{4}$ in. radius at ends of counterweights, **FILE** to remove all sharp edges and **POLISH** 14 Y 2 (rear)

ASSEMBLE 14 Y 1 (front) to 14 Y 2 (rear) with master balancing weight in position to crank pin

CHECK for balance and **REMOVE** stock from outside diameter of counterweights to bring crankshaft into balance

American engine lathe

CUT (2) $5/16$ in. and (3) $\frac{1}{2}$ in. threads on 14 Y 1 (front) crankshaft and **FILE** lead ends of thread American engine lathe

DISASSEMBLE 14 Y 2 (rear) from 14 Y 1 (front), use wedge furnished to spread slot in 14 Y 2 (rear) crank

FILL all projections on crank pin

DRILL (8) $17/64$ in. holes at end of 14 Y 1 (front) crank and **REMOVE** burrs

American radial drill

POLISH crank pin on 14 Y 1 (front) crank

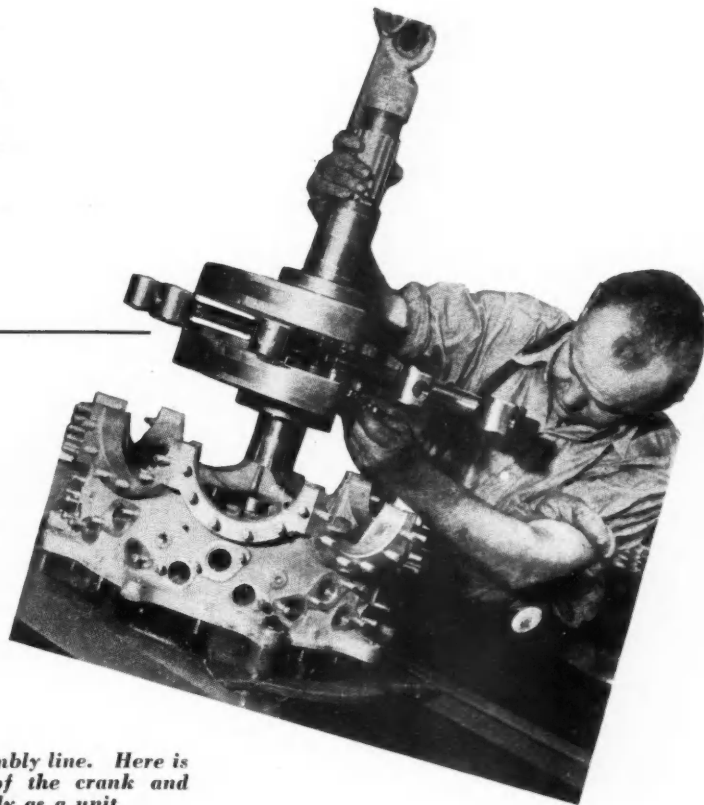
American engine lathe

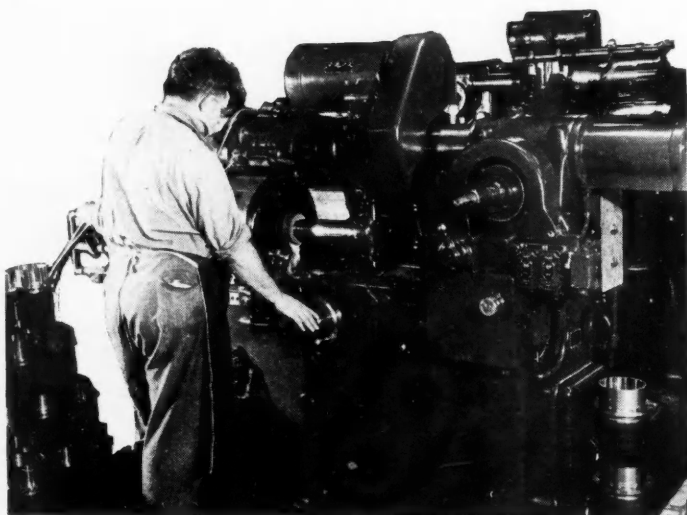
INSPECT

Crankshaft balancing is a rather interesting operation, principally because the single-throw crank requires only static balance. This is performed on a very simple piece of equipment consisting of a Delta drilling head used in conjunction with the static balancing rollers attached to the bench, as illustrated.

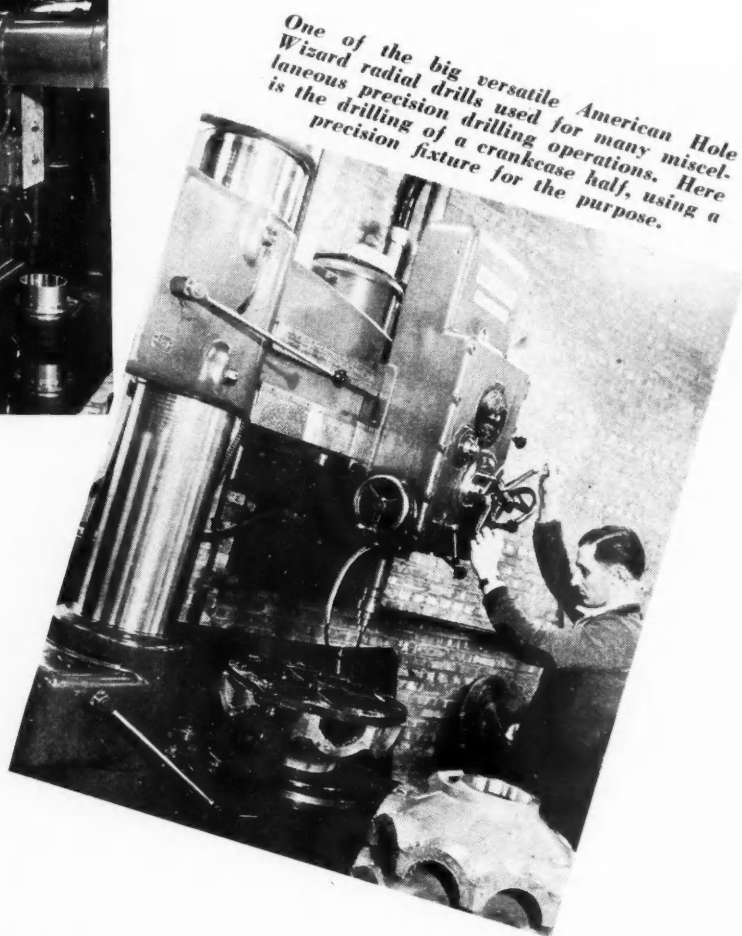
After machining, the finished crank assembly is inspected on a Magnaflux machine

On the final assembly line. Here is the installation of the crank and rod assembly as a unit.





Grinding the inside bore of the cylinder barrel on a Bryant chucking grinder. This is one of a battery of new Bryant grinders of various types.



One of the big versatile American Hole Wizard radial drills used for many miscellaneous precision drilling operations. Here is the drilling of a crankcase half, using a precision fixture for the purpose.

to assure freedom from minute flaws or surface imperfections.

The master rods and link rods also offer some interesting machining operations, routed over many items of equipment. High spotting some of the operations, note first the operation of grinding the bores for the link rods, in the master rod. This is done on one of the Bryant internal grinders, fitted with a special indexing fixture which provides a precise indexing for each of the bores in the same setting in the machine.

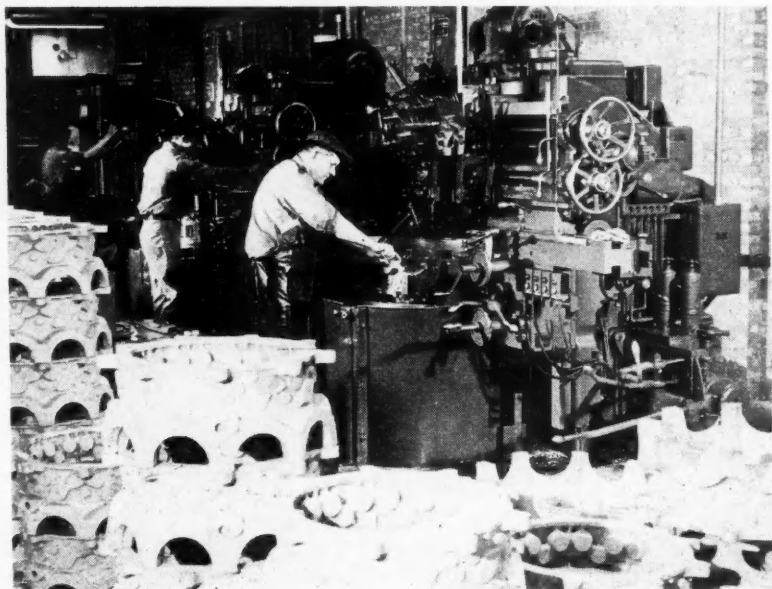
Too, there is the battery of two new Heald No. 47A precision boring machines tooled for boring both ends of link rods and master rods. One of these is used for boring both ends of link rods simultaneously, using two spindles fitted with Carboloy fly cutters. The second machine is tooled for the master rod, also has two spindles to handle both ends

simultaneously. However, the latter machine handles the master rods in two different settings—once for boring the forging, and a second time for finish-boring the pressed-in housings. This machine, too, is fitted with Carboloy fly cutters.

Finally, some comment may be made on the battery of two, four-spindle Motor-Avey sensitive drilling machines found in the line-up. These are the latest type Avey machines with hydraulic feed and electrical control, used for drilling small holes in a variety of miscellaneous parts.

Typical of the work which requires painstaking care is the accessory case. It features a multiplicity of holes and small bores with fine tolerances not only

(Turn to page 414, please)



View of the new Bullard V-T-L which is used, among other things, for the machining of the rear half of the crankcase. In the background is an older Bullard V-T-L machine and an American Hole-Wizard. Overhead may be seen some of the new Fluorescent lighting units which contribute so effectively to better seeing.

INVOLUTE SPLINES

BY THE SHAVING METHOD

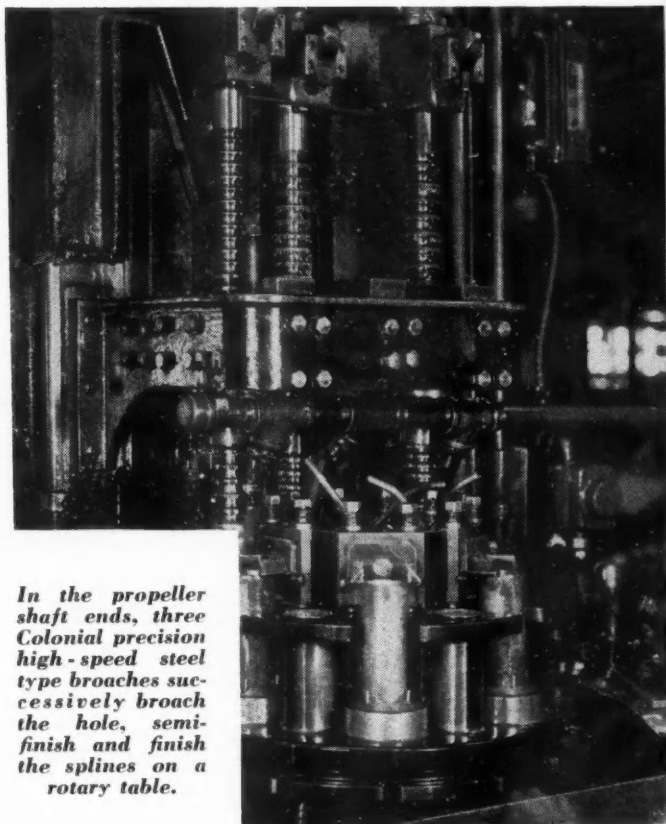
AN innovation in the machining of splines on automotive propeller shafts is now permitting the production of such splined parts in large scale production with no measurable backlash.

Developed at the Detroit plant of Universal Products Corporation, the new process essentially consists of an adaptation of the crossed-axis shaving process extensively used in producing accurate gears to the finish machining of the splines, while equivalent accuracy of the female part is obtained through the use of high precision broaches. The savings made on the hobbing operation alone, it is said, offset the expense of the shaving operation.

To permit the use of this type of equipment, the splines are actually developed involute teeth. In addition to permitting the use of the crossed-axis gear shaving process the tooth design is claimed to provide a stronger assembly, since the increased width at the root of the teeth increases resistance to shear and the increased contact area increases the life of the splines (*Turn to page 403, please*)



The splines on the universal joint yokes are finished on Series 900 Michigan rack type gear shaving machines.

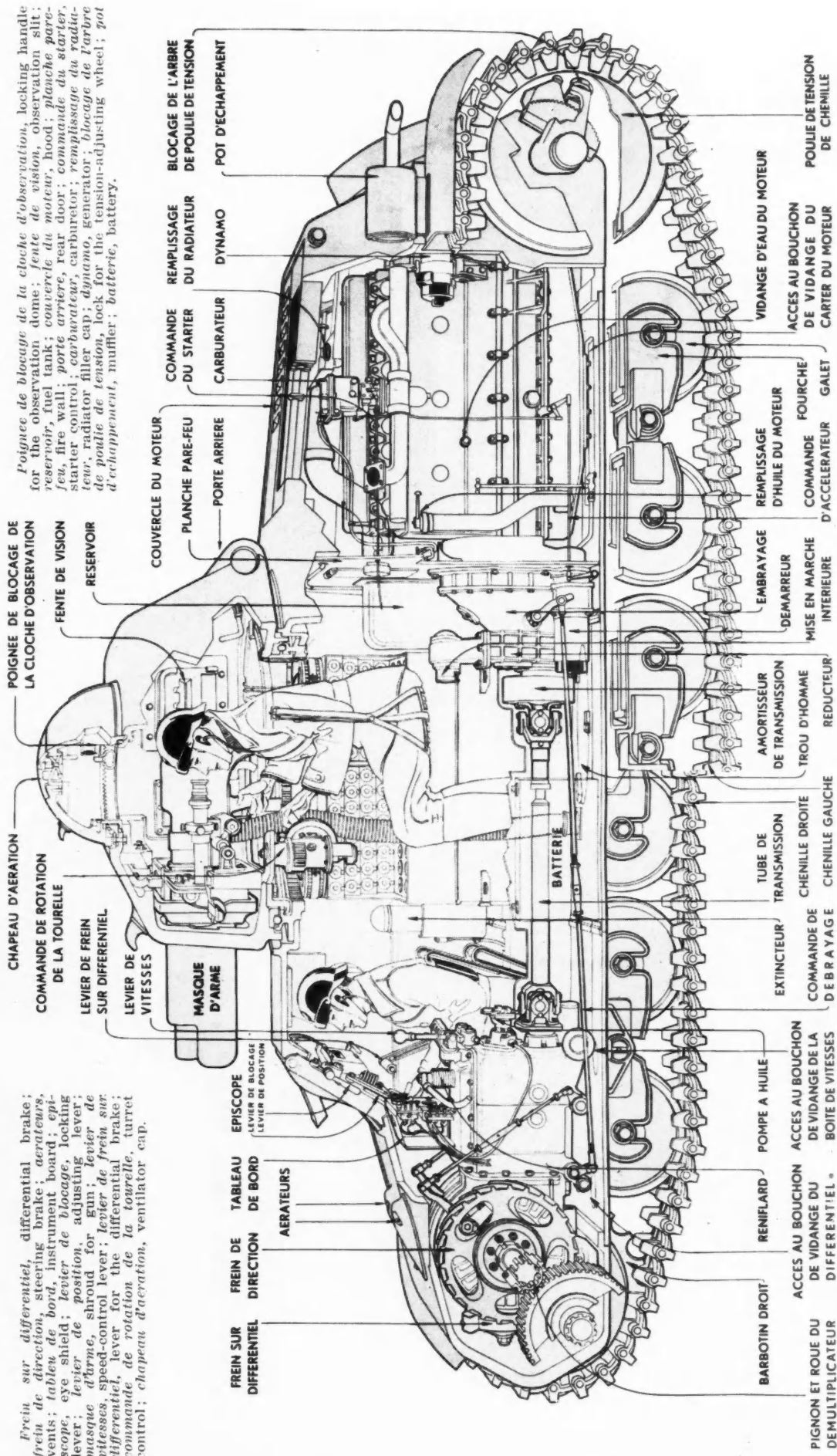


In the propeller shaft ends, three Colonial precision high-speed steel type broaches successively broach the hole, semi-finish and finish the splines on a rotary table.



Splines are semi-finish hobbed on Cleveland single-spindle machines. 3-spindle rotary hobbing machines are also used for this operation.

Hotchkiss Tank Model H 35. M 39



Frein sur différentiel, differential brake; frein de direction, steering brake; aérateurs, vents; tableau de bord, instrument board; épiscopes, eye shield; levier de blocage, locking lever; levier de position, adjusting lever; masque d'arme, shroud for gun; levier de vitesses, speed-control lever; levier de frein sur différentiel, lever for the differential brake; commande de rotation de la tourelle, turret control; chapeau d'aération, ventilator cap.

Poignée de blocage de la cloche d'observation, locking handle for the observation dome; fente de vision, observation slit; réservoir, fuel tank; couvercle du moteur, hood; planche pare-feu, fire wall; portes arrière, rear door; commande du starter, starter control; carburateur, carburetor; remplissage du radiateur, radiator filler cap; dynamo, generator; blocage de l'arbre de poulie de tension, lock for the tension-adjusting wheel; pot d'échappement, muffler; batterie, battery.

Barbotin droit, right-hand sprocket; reniflard, blower; pompe à huile, oil pump; extincteur, extinguisher; tube de transmission, transmission tube; amortisseur de transmission, transmission compensator; embrayage, clutch; démarreur, starter; remplissage d'huile du moteur, engine oil filler; vidange d'eau du moteur, water-jacket drain; pignon

et roue du demultiplicateur, pinion and gear of speed reducer; access au bouchon de vidange du différentiel, opening giving access to drain plug of differential housing; access au bouchon de vidange de la boîte de vitesses, access to the drain plug of the transmission; commande de débrayage, clutch-control linkage; chenille droite, right-hand track

chain; chenille gauche, left-hand track chain; trou d'homme, man hole; réducteur, reduction gear; mise en marche intérieur, inside starter; commande d'accélérateur, accelerator control; fourche, yoke; galet, roller; access au bouchon de vidange du carter du moteur, access to the crankcase drain; poulie de tension de chenille, track-chain adjustment.

The Hotchkiss 12-Ton Tank

Hitherto Unpublished Details and Drawings of This French Army Vehicle

BECAUSE of its simple design, the Hotchkiss 12-ton army tank was being produced by the famous French World War I armament and gun manufacturer at the rate of eight a day when France fell to the German invaders. Plans had been completed for manufacture at the unprecedented rate of 20 a day. The French government had ordered 5000 units from the Hotchkiss concern early in 1936 after exhaustive tests under simulated combat conditions. About 2000 had been delivered before the fall of Paris.

Heretofore unpublished drawings and description of the Hotchkiss tank were furnished to AUTOMOTIVE IN-

DUSTRIES by H. M. Ainsworth, the company's managing director in an exclusive interview in his company's New York office. The most striking feature about the tank is that it was built up chiefly of six heat-treated armor steel castings. As compared with more conventional designs, this:

1. Reduced the number of armored parts to a minimum, as these six castings replaced several times their number in competitive designs where several times their number of rolled armor plates were used for tank hulls. This also:

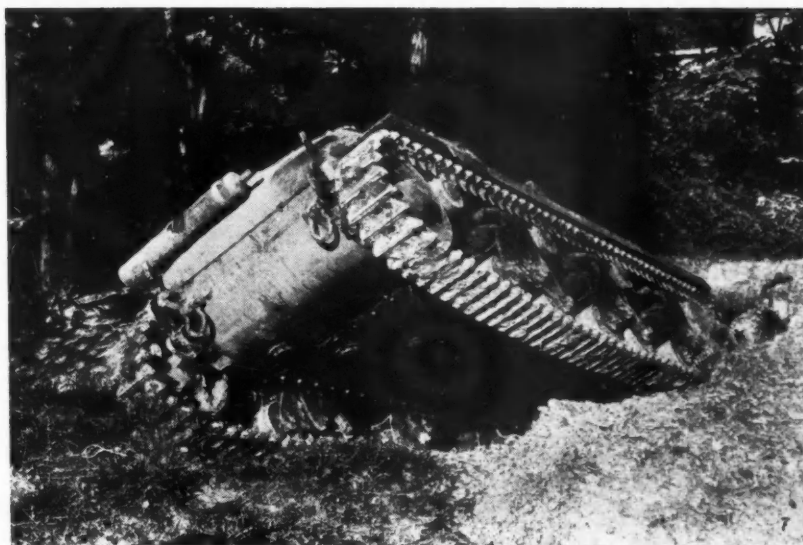
2. Reduced the number of man-hours for fabricating and assembly to a new low figure. About 2000 man-hours were required for producing this tank in a smaller of the six Hotchkiss plants in the environs of Paris, as compared with several times that amount of labor on other tanks of similar size and weight. Unskilled and semi-skilled labor was largely used.

3. Permitted the design of wide curves at all corners and surfaces subject to shell fire. This "streamline" effect tended to deflect enemy shells. Numerous "inside corners" were also dispensed with; these pockets have been found to be particularly vulnerable in combat. Furthermore, this design reduced the impedance in thickets and wooded areas because



Two of the 12-ton tanks in French army manoeuvres.

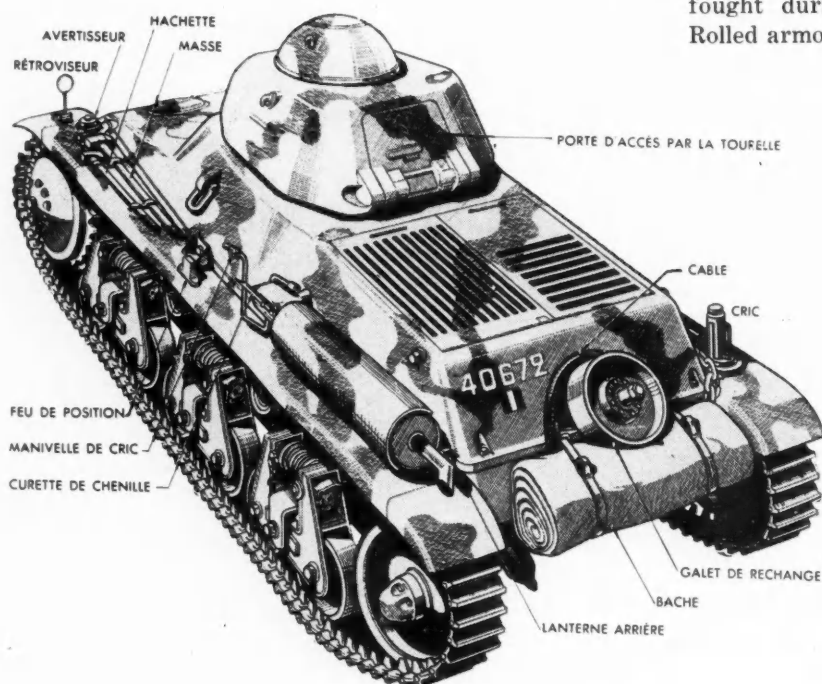
The 12-ton Hotchkiss tank climbs out of a ditch. The bottom is covered with a $\frac{3}{4}$ in. sheet of rolled armor plate.



The Hotchkiss 12-ton tank, camouflaged and ready for delivery, mounting a 37 mm. cannon and a 7.5 machine gun.

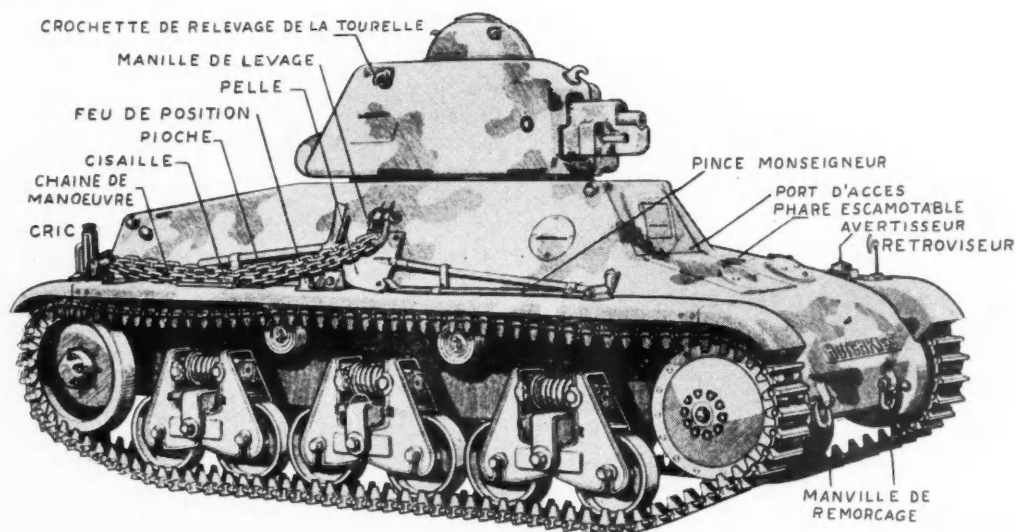
(Below) Rear view of the French Hotchkiss 12-ton army tank, showing the wide curves which were made possible by using cast steel armor sections. The top portion of tanks have been found to be particularly vulnerable in modern warfare.

Retroviseur, rear-view mirror; avertisseur, signal; hachette, axe; masse, sledge hammer; porte d'accès par la tourelle, entrance door in turret; feu de position, clearance lamp; manivelle de cric, jack handle; curette de chenille, track-chain scraper; cable, cable; cric, jack; lanterne arriere, rear lamp; bache, tarpaulin; galet de rechange, spare idler wheel.



(Right) Easy accessibility of the suspension units is shown. The sweeping lines of the tank tend to deflect enemy cannonade. Overall height, 7 ft.

Crochette de relevage de la tourelle, hook for lifting turret; manille de levage, lifting yoke; pelle, shovel; feu de position, clearance lamp; pioche, pick; cisaille, shears; chaîne de manoeuvre, maneuvering chain; cric, jack; pince monseigneur, crow bar; port d'accès, entrance door; phare escamotable, disappearing headlamp; avertisseur, signal lamp; retroviseur, rear-view mirror; manille de remorçage, towing yoke.



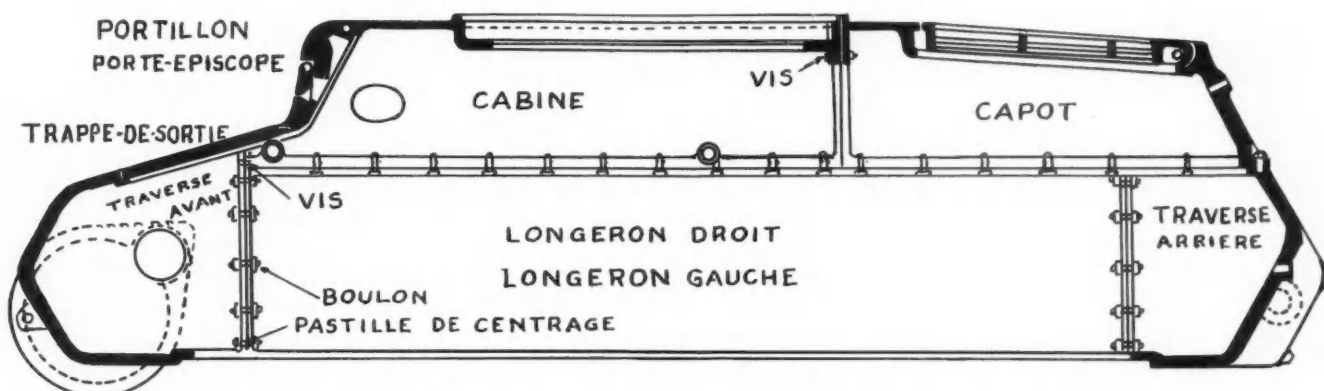
the sleek hull slid around obstacles with relative ease.

Mr. Ainsworth recounted that a great deal of prejudice in respect to cast steel armor sections had to be fought during the period of developing this tank. Rolled armor plate was thought to have better ballistic

qualities than would have castings of similar steel. But trials demonstrated that cast materials of the same chemistry, if heat-treated, were well up to the standards required. Enormous strides have been made in recent years in the development of cast armor sections, both in America and abroad.

The six steel castings of the Hotchkiss tank weighed from 1250 to 2000 lb. each. These were found to present no difficulties in casting, machining, or heat-treating, and no equipment or machinery of unusual size or type was needed. Heavy flanges cast integrally on the inside surfaces of the armor sections provided means for bolting the sections together. The bolts were thus protected from gun fire.

The tank was designed so that it



Sections requiring greater strength are readily secured by the use of castings, instead of using rolled armor plates more generally used in European design. Overall length of the newer Hotchkiss 12-ton tank, 15 ft. 2 in.; overall width, 6 ft. 10 in.

Portillon porte-episcopes, eye-protector carrier; trappe de sortie, exit trap door; traverse avant, front cross member; vis, screw; boulon, bolt; pastille de centrage, dowel bushing; cabine, cab; capot, hood; longeron droit, right-hand side member; longeron gauche, left-hand side member; traverse arriere, rear cross member.

could be assembled up to the top half, or cover sections, without impedance of any superstructure. The engine, transmission, drive mechanism, controls, and other equipment was installed while the lower half of the hull was as open as a bath tub. The tank could then be driven for trial and inspection before the top section was lowered in place and securely bolted. It was found at the Hotchkiss plant that all of the assembly could be done by unskilled labor. A few wrenches displaced the need for many riveting hammers and welding torches.

The French army command was particularly interested in the ready accessibility of all parts to simplify repairs in the field whenever needed. Periodic inspections were required. The use of relatively few bolts of large size, instead of riveting and welding, proved advantageous in this respect.

Each suspension unit of the tank was independent, so that it could be dismounted or replaced.

The Hotchkiss tank was powered by a 6-cylinder, water-cooled gasoline engine of 366 cu. in. capacity, which developed 130 hp. at 1800 r.p.m. The engine was equipped with an electric self-starter, and provision was also made for manual starting both from the inside and outside of the tank.

The gear box, installed ahead of the driver, was a five-speed-and-reverse unit. Constant mesh transmission gears with forced feed lubrication were provided. One of the interesting design features of the tank was the flexible coupling between the engine and transmission to reduce shocks on the gears and the shafts.

Steering was effected in conventional manner by controlled differential action. The controlled differential brakes were easily accessible and were provided with extra cooling by inducing an air current directly over them. The rated speed of the tank was 25 m.p.h., and the cruising range 120 miles. The tested climbing ability was 40 deg.

More About the Ford Aircraft Engine

FURTHER details of the liquid-cooled aircraft engine being developed by the Ford Motor Co. were given in a brief talk by C. W. Van Ranst, Ford's chief aircraft engineer, at the ASTE Convention in Detroit. It is to be a V-type, 12-cylinder, liquid cooled engine with a displacement of 1650 cu. in. (same as the Liberty engine). The stroke is given as 6 in., which makes the bore approximately 5.4 in. On the basis of test results with the two-cylinder test engine (AUTOMOTIVE INDUSTRIES, Feb. 15), the output is expected to range between 1800 and 2000 hp. at 3600 r.p.m. The compression ratio is 7.5. It is estimated that the engine, complete with all accessories, will weigh around 0.9 lb. per b. hp.

The cylinder block and crankcase are a single aluminum casting which is fitted with dry liners of centrifugally-cast, heat-treated steel. The crankshaft, which will be of extremely rigid design and fully counterbalanced, will be produced by the same methods as used for the crankshaft of the Ford V-8. Side-by-side connecting rods with floating bearings are em-

ployed. Pistons have a length substantially equal to the bore, being made relatively long to ensure better cooling and improve ring performance.

Solid injection is to be used, with an injector for each cylinder, timed to discharge after the air has been fully compressed. This arrangement is said to ensure good mixing and distribution, and it aids with the cooling of the engine, owing to the scavenging action of the air during the latter part of the exhaust stroke.

A turbo-blower with integral intercooler serves to supercharge the engine. Although there is no mechanical connection between the supercharger and the engine, all of the mechanism is designed for unit mounting so as to simplify the installation problem on the part of the aircraft producer. The turbine is controlled by means of a "waste" gate in the exhaust system—a damper which regulates the percentage of exhaust through the supercharger. Preliminary estimates indicate that the supercharger will take 100 hp. at take-off and 440 hp. at an altitude of 32,500 ft.

W

ITH THE defense program uppermost in their minds, industrial executives, engineers and production men gathered at the A.S.T.E. Show in Detroit to study the offerings of machines, tools and other manufacturing equipment of some 250 companies. The event, the National Machine & Tool Progress Exhibition, was under the sponsorship of the American Society of Tool Engineers, which also held its annual convention and technical sessions at the same time.

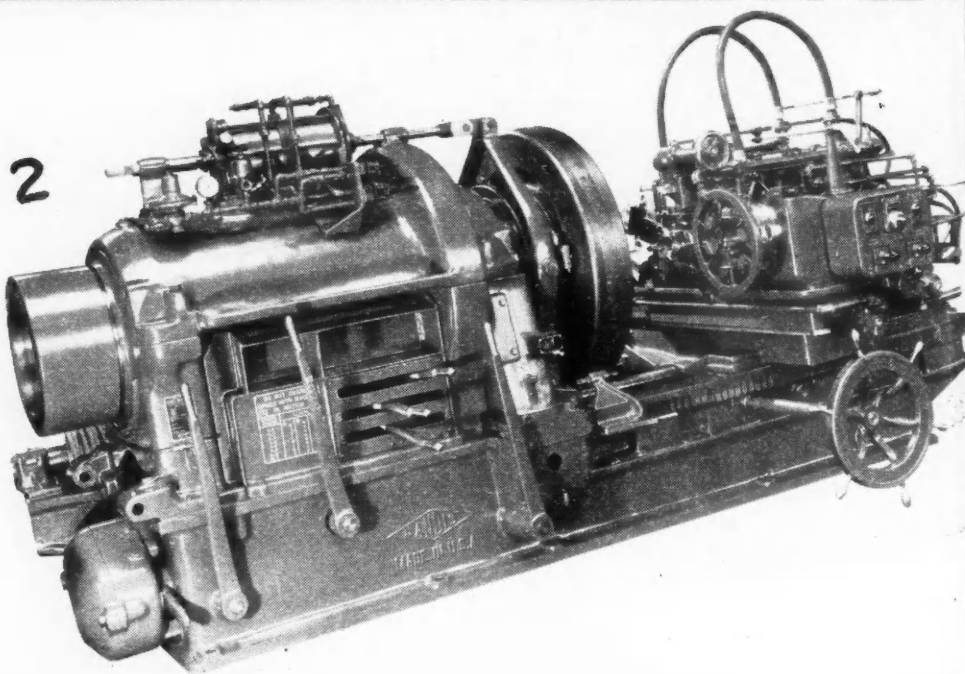
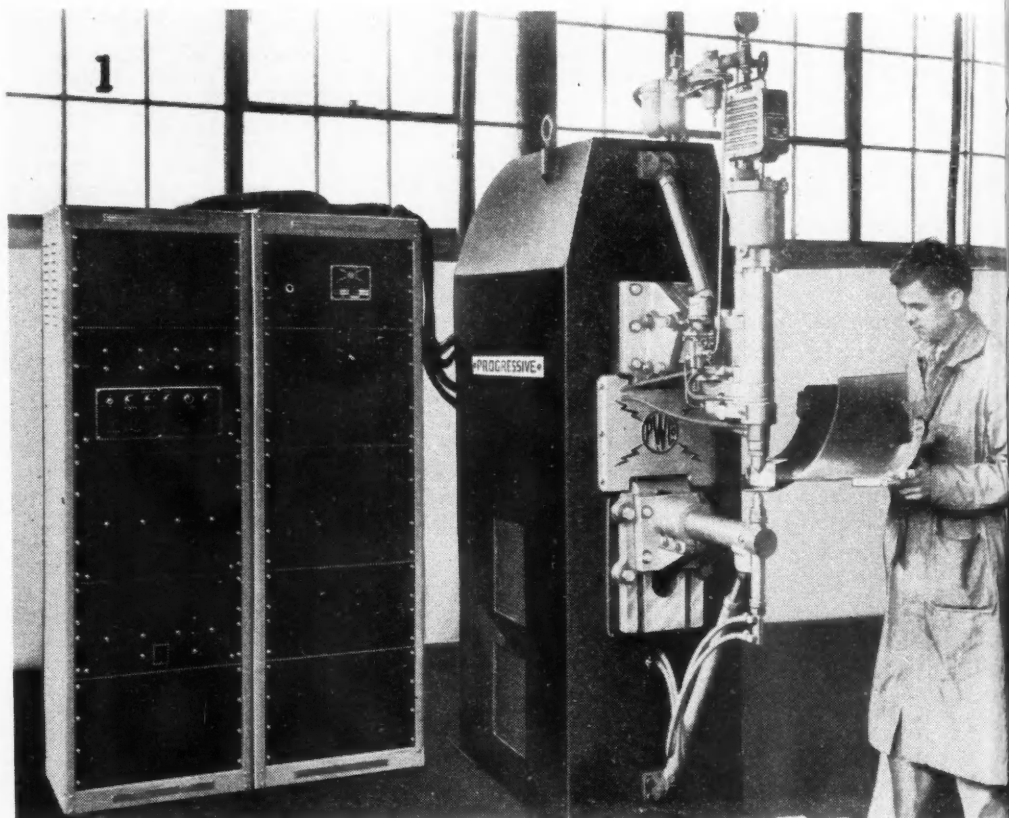
Many of the new items of production equipment, which are on exhibition as this issue of *AUTOMOTIVE INDUSTRIES* goes to press, are described in these columns from advance material furnished by their manufacturers. They are included together with the new products of other manufacturers to make up this installment of our regular department **MEN AND MACHINES**.

A NEW, high-speed production process for spot welding aluminum alloy sheet for aircraft has been announced by Progressive Welder Company, Detroit. Involving an entirely new principle of operation, the process is said to produce welds in aluminum alloy with a uniformity equal to that possible in welding steel in production and thus may prove to be a simple solution to the problem of mass production of airplanes.

This new 3-phase short wave process consists, essentially, of passing the current through a converter, which eliminates the negative portions of the wave. The resulting pulsating current has a time cycle of 300 deg. instead of the 360 deg. The current then passes through the welding transformer amplifying the current. The resulting secondary current wave form is said to be ideal for the welding of aluminum. The current rises to its maximum almost instantly, stays at this value for practically the entire

duration of the weld, and then drops to zero in an extremely short period of time.

A timer panel for the various sequences of the welding operation, which also houses the ignitron tubes, provides completely automatic operation for an unusually wide range of aluminum welding operations. With it weld time can be anywhere from the maxi-



MEN and MACHINES

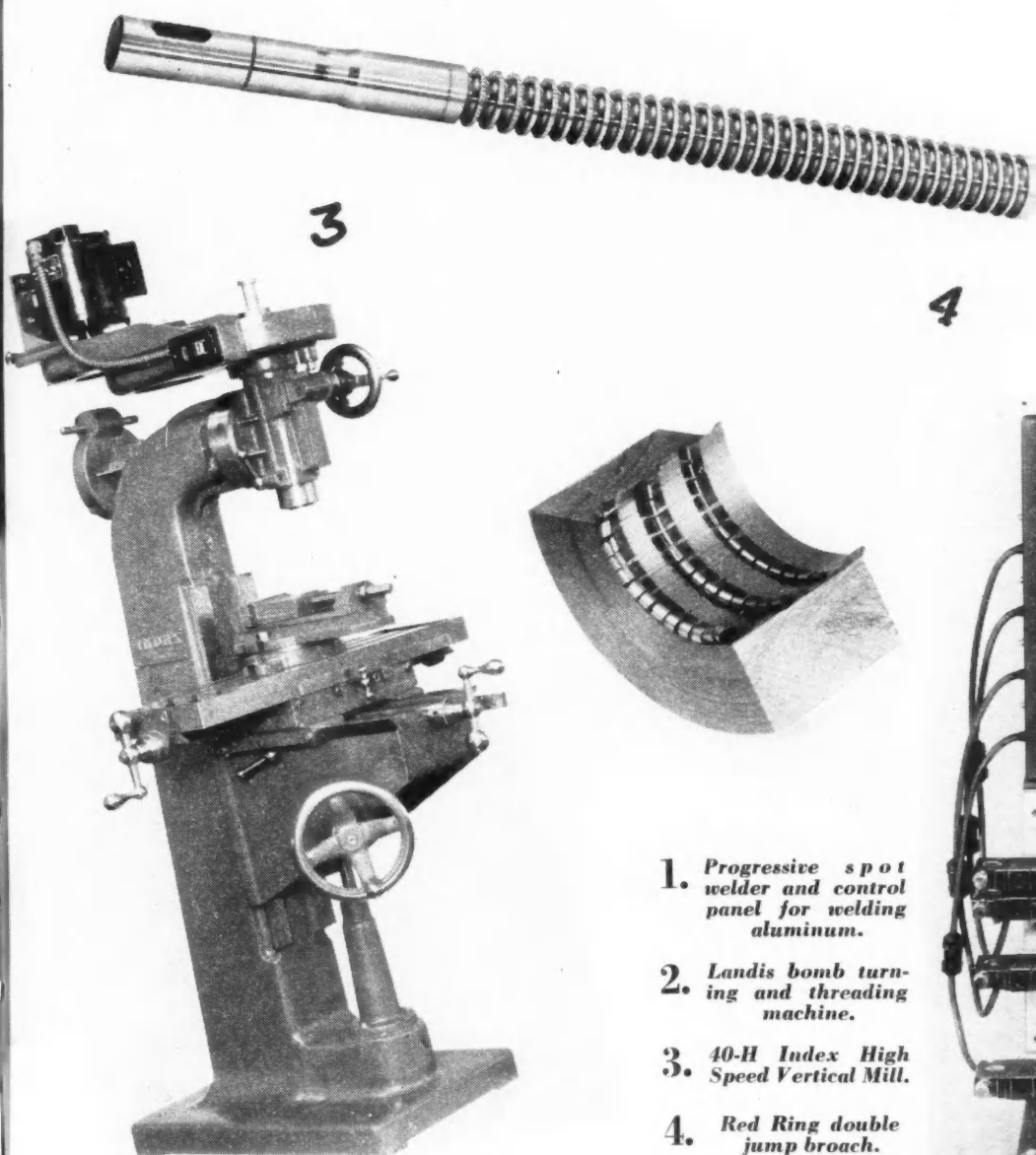
mum, $1/72$ of a second down to zero. Thus, the adjustment provides for correct welding time for any conceivable aluminum spot welding job from the thinnest weldable sheet up to two $1/8$ by $1/8$ sections and is obtained by simple manipulation of two control knobs on the panel.

Automatic repeat timing, which allows sufficient interval between welds to re-position the work, permits making any number of welds in succession automatically without re-closing the pilot device for each weld.

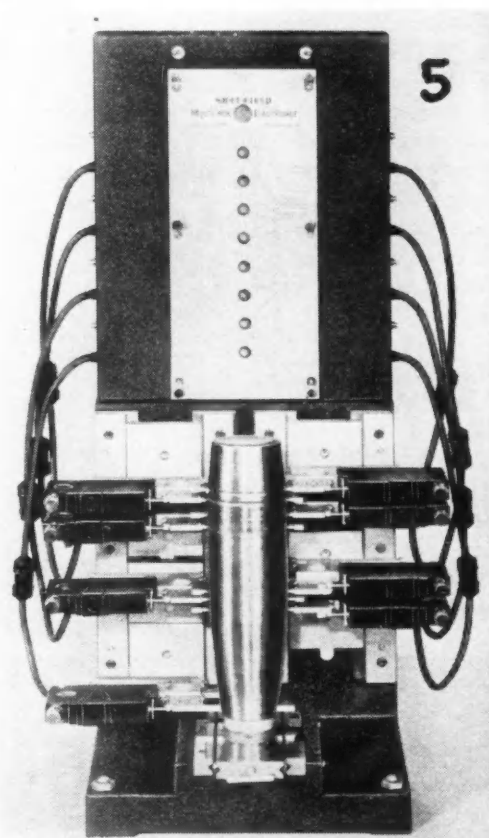
A MACHINE for completely finishing the tail end of bombs at one chucking has been designed by the Landis Machine Co., Waynesboro, Pa. Three tool units attached to a carriage and cross slide are provided for turning, facing, chamfering, boring, recessing, and threading operations.

One tool unit, consisting of a tool head with four tangential type cutters and attached to a hydraulically controlled slide, turns, faces and chamfers the end of the bomb. A second tool unit has a hydraulically controlled slide, to which is

attached an adjustable six-blade cutter head for finishing the bore, and an auxiliary hand operated tool slide for machining the angular face and undercutting on the body of the bomb and the adjacent recess. The third tool unit, attached in a fixed position to the



1. Progressive spot welder and control panel for welding aluminum.
2. Landis bomb turning and threading machine.
3. 40-H Index High Speed Vertical Mill.
4. Red Ring double jump broach.
5. Multichek Electri-gage.



cross slide, comprises a Landis 40-AX Landmatic die head, which is especially designed for cutting fine pitch threads on large diameters. A leadscrew mechanism is provided on the machine to be used in conjunction with the Landmatic die head. The leadscrew is employed to propel the carriage along the ways of the machine so that the die head advances onto the work at a uniform rate of speed.

This machine is equipped with a variable speed, motor driven headstock having an eight-speed, sliding gear transmission. A pneumatically operated chuck is attached to the front end of the machine spindle for centering and driving the bomb.

SHEFFIELD GAGE CORP. of Dayton has announced four new checking instruments of the precision type, consisting of the Visual Gage, Precisionaire, Multichek Electrigan and the Thread Lead Checking Instrument. The Visual Gage, which incorporates the frictionless Reed mechanism and light beam lever arm, can be used for tool room checking, checking production gages, process inspection, checking master gages and checking purchased parts. It is built in five magnifications—10,000, 5000, 2000, 1000 and 500 to 1.

The Precisionaire is an air gage for the rapid checking of either actual or average internal diameters, out-of-round and bell mouth condition of long bores. It is made in two models, one to which the work is presented and the other which is presented to the work. Quick checking of rifle and gun bores is one of its features.

Checking a number of dimensions simultaneously and showing by individual signal lights whether each dimension is undersize, oversize, or within prescribed tolerances is the purpose of the Multichek Electrigan, which will handle parts of large size. A master signal integrating all individual dimension signals is available.

For checking screw lead or rack teeth quickly and accurately with precision gage blocks as direct reference, the Thread Lead Checking Instrument is built in two models, bench or portable types. It has a visual gage head that includes the Reed mechanism and various magnifications.

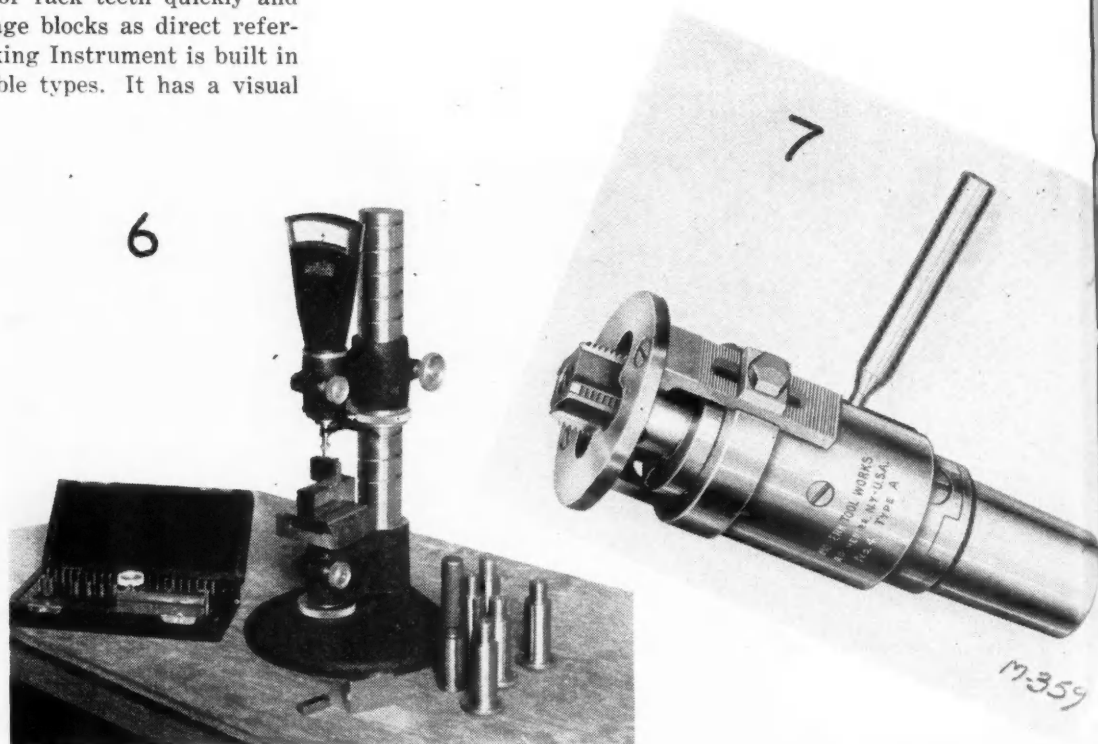
TWO NEW Red Ring products of the National Broach & Machine Co., Detroit, are a circular broach and a double jump broach, which are made of a special alloy steel having a high resistance to surface wear without being brittle. It is said to combine the elasticity of high

speed steel with the hardness and cutting properties of cast tools.

The circular broach is designed for cutting a 0.037-in. circular tee slot at one revolution and at a production rate of approximately 100 per hour. Accuracy and production speed are claimed to be higher than can be attained with either milling or boring. The double jump broach was developed for cored or pierced holes in castings or forgings that in broaching require relatively heavy cuts in order to keep the cutting edges of tools below the very hard scale on the inside surface of the hole.

SCULLY-JONES & CO., Chicago, now offers a new line recessing, grooving, undercutting, necking and facing tools of the automatic type for use on automatic screw machines, turret lathes, drill presses and horizontal boring mills. In these automatic tools a ball bearing stop collar strikes against the work, stopping the forward movement, while the rear portion of the tool continues in motion, feeding the tool bit into the work. Adjustment is provided for the tool bit after regrinding, for location of the groove, for correct depth setting in controlling the diameter of the recess and also for length of recess or groove in tools where the bit moves forward after reaching the maximum diameter of its cut. Holes as small as 5/16 in. diameter can be recessed with grooves of varying widths and depths.

BOTTOM HOLE tapping with standard chasers is one of the features of the new line of collapsible taps announced by Modern Tool Works, Rochester, N. Y. They are made with a one-piece body, which has a solid end. In this construction there is no end plate or cap, and regular chasers extend beyond the tap body, permitting close to bottom tapping. This de-



sign also adds to the rigidity and strength of the tap as chaser slots cannot spread and chasers are securely and accurately held in position. Collapsing is positive and always at the same point, being effected by an adjustable hardened steel trip plate coming in contact with the work which causes the chasers to collapse quickly, leaving the threads clean and unutilated.

The stationary type tap is fitted with a handle for resetting after collapsing and the rotary type has a sleeve for this purpose. In this way the stationary type can be easily converted to the rotary type by removing the handle and replacing the sleeve. These collapsible taps are regularly made in 12 sizes from 13/16 in. diameter to 3 1/4 in. with each size having a liberal range of threading capacity.

THE LYON IRON WORKS, Greene, N. Y., has introduced another design of hydraulic die handling truck that has a revolving table arranged to revolve with stops at each 90 deg. When in its standard position, the table extends about one foot beyond the edge of the wheels so that the table may be put close to the press when taking out or putting dies into the press, particularly those where the base of the press extends out beyond the bed of the press. This arrangement is also very convenient when taking dies on and off shelves where the lower shelves may have dies stored on them that protrude beyond the edge of the shelves. The table is equipped with a winch for pulling dies on and off of the table.

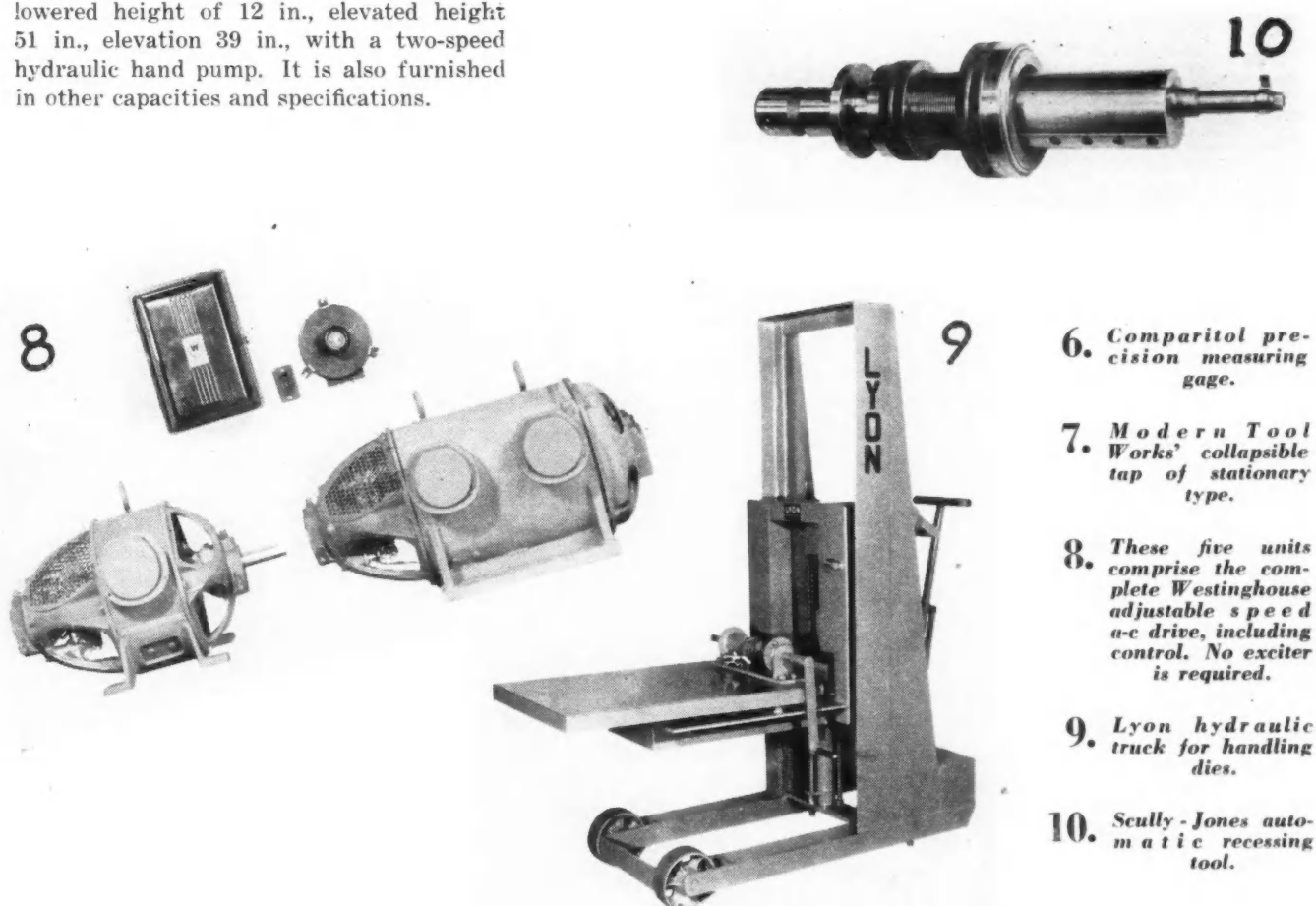
The truck shown in the illustration has a 1000-lb. capacity, a table 24 in. by 36 in., lowered height of 12 in., elevated height 51 in., elevation 39 in., with a two-speed hydraulic hand pump. It is also furnished in other capacities and specifications.

DESIGNED especially for industrial applications requiring smoothly adjustable speeds over wide ranges with constant torque, in locations where only AC supply is available, a new 10 to 1 adjustable-speed drive, which uses a series circuit without the usual exciter, is announced by the Westinghouse Electric & Mfg. Co. It is available in ratings from 1 to 15 hp., with a standard speed range of from 175 to 1750 r.p.m. for two- or three-phase operation on 220, 440, 550-volt, 60-cycle systems.

The new drive has five parts, including a single-unit motor-generator set that consists of a squirrel-cage induction motor driving a series DC generator, which supplies operating voltage for a DC series motor coupled to the driven load. In parallel with the generator series field is a rheostat which controls the driving motor speed. Control apparatus consists of an across-the-line starter for the squirrel-cage motor and a push-button station.

Optional features include dynamic braking and inching. Dynamic braking requires no external braking resistor, but employs a braking field wound into the motor.

THE 40-H Index High Speed Vertical Mill, manufactured by the Index Machinery & Tool Co. and marketed by the Blank & Buxton Machinery Co.,
(Turn to page 404, please)



6. Comparitol precision measuring gage.
7. Modern Tool Works' collapsible tap of stationary type.
8. These five units comprise the complete Westinghouse adjustable speed a-c drive, including control. No exciter is required.
9. Lyon hydraulic truck for handling dies.
10. Scully-Jones automatic recessing tool.

THE MAJOR functions of a compression ring are, first, to seal the piston against the leakage of the combustion gases throughout the entire range of engine speeds and loads; second, to prevent the passage of excess oil to the combustion chamber; and third, to dissipate heat from the piston to the cylinder wall effectively.

Sealing the piston against blowby at high reciprocating speeds has become an increasingly important problem in recent years. Excessive blowby of the combustion gases is associated with rapid ring wear and in extreme cases, ring breakage, which, in turn, often brings about destruction of ring grooves in the piston. Curves of the rate of blowby plotted against engine speed show quite distinctly the performance of compression rings and their ability to seal the piston effectively. Such curves also show the critical period where rate of blowby changes suddenly and becomes excessive. The unstable performance of the piston rings is attributed to ring flutter which takes place where the blowby curve shows a marked change upward.

It has been found that the critical reciprocating speed where in a ring starts to flutter can be correlated with the width of the ring. In other words, if all considerations which do affect the performance of a ring at high speed, namely, ring shape, thickness, tension, cross-section of design, etc., are held constant, it has been definitely proved that the width of the ring is a fundamental factor in the determination of its high speed performance.

Referring to the drawing, it will be observed that these blowby curves show the critical engine speed for rings of different widths, at which flutter occurs. Slight deviations, of course, are obtained on different engines, depending on the condition of bore, type of piston, piston fits, piston stability, etc. However, the curves shown can be considered representative of curves taken from all types of relatively high speed engines. These curves represent the performance of the plain or rectangular cross section type of compression ring. It will be noted that Curve A shows the blowby characteristics of the 3/16-in. wide ring and that the break in blowby or the period of ring flutter occurs at approximately 2600 r.p.m.; Curve B shows the characteristics of the 5/32 in. ring with a critical period at 3000 r.p.m.; Curve C, the 1/8 in. ring with a critical period at 3500 r.p.m., and Curve D, the characteristics of the 3/32 in. ring with a critical period at 4000 r.p.m. These curves clearly show the advantage of the

* Chief Engineer, Sealed Power Corporation.

narrower type ring with respect to its ability to maintain an effective seal further up the range of engine speeds. The ability of the 3/32 in. ring to remain stable up to 4000 r.p.m. as well as its ability to carry on to 4500 r.p.m. without excessive blowby is particularly noteworthy and should be compared with the rapid increase in blowby with wider rings as shown on Curves A, B, and C, above their respective critical periods of ring flutter.

As has been pointed out, the chart deals only with the performance of plain, rectangular cross section compression rings of various widths. Certain modifications in cross section shape which have been adopted

Ring Width and Blowby

in current practice yield, to different extents, materially improved high speed performance in 1/8 in. width and show still greater improvement over the plain ring, when reduced to the 3/32 in. size. Tests have shown that some of these modified types in this latter width give consistent performance with no critical period of ring flutter up to 5000 r.p.m. When comparing the blowby characteristics of these modified design 1/8 in. and 3/32 in. compression rings, it must be remembered that the condition of wear of ring and ring grooves tends to offset the improvement brought about by design changes and returns the performance of the ring to the basic characteristics of a plain compression ring. Obviously, the lighter 3/32 in. ring, with its reduced inertia and with its equal or greater piston land contact area, is not as much affected by wear and will retain its original performance for a longer time. When wear does occur to offset the improvement made by change in design, the stability of the 3/32 in. plain ring makes it the natural fundamental ring on which to incorporate such design changes.

The trend toward narrower rings has been brought about, of course, by the increase in engine speeds.

However, the assumption that narrow rings wear faster than wide ones has somewhat retarded their acceptance. These assumptions, no doubt, were drawn from experience on the slower speed engines of a few years ago where present day care in finishing cylinder bores and the removal of manufacturing dirt and abrasives did not exist. Under conditions wherein rough bores and abrasion were prominent in engines, it was natural to assume that wide piston rings would wear longer than narrow rings. On the other hand, it is a known fact that piston ring wear, as well as cylinder wear, is excessive under conditions of high speed blowby operation. Smooth bore finishes, the absence of dirt and abrasion, and the installation of air cleaners as well as oil purifiers in new engines have reduced to a great extent excessive wear from purely abrasive

ring. Effective oil control in conjunction with blowby control means long effective ring life. However, oil control resulting from excessive blowby is very detrimental and promotes rapid wear.

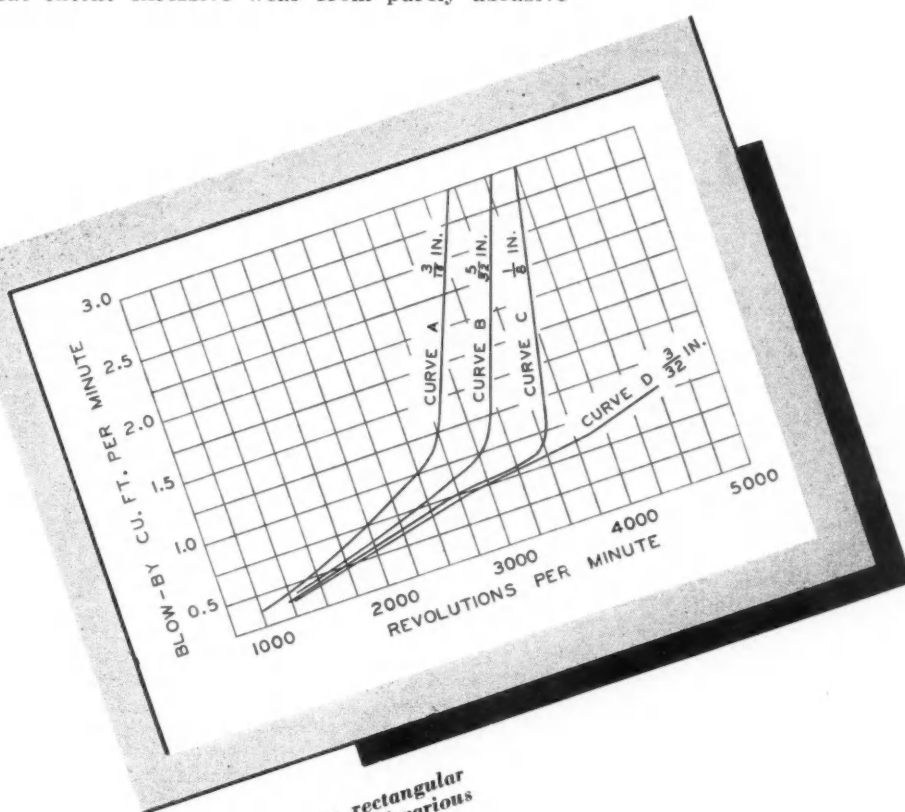
The bottleneck for heat transfer from the piston to the cylinder wall through the rings is not as may be commonly supposed the face of the ring, but rather the contact area between the sides of the ring and the piston groove. Consequently, the narrowing of the ring has little or no effect on its heat transfer characteristics.

Due to the good thermal contact between the ring face and the cylinder wall and the less positive contact between the sides of the ring and the piston groove, it has been proved that a piston ring can dissipate more heat to the cylinder wall than it can receive from the piston land. This points out the advantage of increased ring thickness or the use of the so-called high wall thickness ring, especially in the top groove of the piston. Increasing the area of contact between the sides of the ring and piston groove is an advantage not only from the standpoint of heat dissipation, but also from the reduction of wear. Another point to bear in mind is the stability of the 3/32-in. ring throughout the whole range of engine speeds as previously pointed out, which assures good thermal contact between ring face and cylinder wall at all times. This, of course, would not be true of a

ring operating above its critical period.

At a meeting of the A.S.T.M. Sub-Committee on Glass Fiber and its Products, held at Washington, D. C., recently, the A.S.T.M. decided to undertake a study of the essential properties of sizing for glass yarn, including the preparation of methods of testing. This subcommittee is also investigating the important properties of glass silver for wire insulation and for use as filler, which work will also include the development of test methods. In the four methods completed by this subcommittee last year, covering procedures for the testing of glass yarn, woven fabrics, tubular sleeving and braids, and woven tapes, a test method for pH value will be added this year. This subcommittee also is studying methods for resistance to abrasion of glass yarn and fabrics.

Rate of blowby of plain or rectangular cross-section compression rings of various widths.



conditions. Naturally, then, high speed blowby and its contribution to ring and bore wear becomes a predominating factor, and a reduction in ring width is fully justified if necessary to overcome excessive ring and cylinder wear and extreme cases of ring breakage.

Compression rings have considerable influence on oil control. The best results have been obtained when there is a high unit pressure at the lower edge of the ring approaching that of the scraper type oil control

PRODUCTION LINES

On Pistons

At this writing—and no one knows what will happen next—there is talk that the aluminum supply for pistons may be cut off. This action does not appear to be imperative since, after all, the pistons are the only major parts of an automobile that constitute a drain on the available aluminum supply. Nevertheless, people are worrying about the probabilities of the situation. Actually the problem of making a substitution is not insoluble nor particularly difficult. In the first place, the largest volume of passenger car production, as represented by Ford, Chevrolet and Pontiac, has had years of successful experience with alloy cast iron or special ferrous alloy pistons of surprisingly low weight. Foundry practice and good design have played a major role in that respect. For another thing, most producers have been experimenting with the use of substitutes as a matter of good business and doubtless are ready to make the shift whenever it seems necessary. What happens in the event of a substitution? In the first place, it may be necessary to recheck the bearings to make sure that they can carry the heavier loading and it may be desirable to change to heavy-duty bearings. In the case of the in-line engines, it is quite possible that no correction need be made in the crankshafts to compensate for the extra piston weight. No other change may be needed than that of re-checking the bearings. Certainly, nothing in the cards intimates a shut-down of production lines or a radical change (if at all) in piston tooling, save for foundry equipment.

Controls Unlimited

Many types of remote controls used on aircraft come from the modest factory built up by Charles A. (Slim) Arens. While small, the plant is adequate for the production of a wide variety of small control elements. Within this little plant are found complete facilities for making flexible cable, flexible cable housings, winding and impregnating equipment for outer casings, a self-contained cadmium-plating department, and bench-type machines for sawing, tapping, and light metal cutting operations. Arens controls have been applied in about 40 locations on

aircraft, have many uses in automotive equipment. The line is so varied as to defy description in a brief note. Among the more recent controls is a type which incorporates a vernier for providing both coarse and fine push-pull adjustments. This feature makes it possible to make up controls in banks of two or more for accurate synchronization of marine engines and other powerplants fitted with two or more engines.

Standardize Now

About ten years ago all industry co-operated in a national program of elimination of waste through standardization and simplification. Some of the lessons learned then can stand in good stead today. Many things can be done to expedite the national defense program—measures that will carry on logically after the emergency is past. As a specific example take the standardization of cemented-carbide tooling as urged by Carboloy. Some of the larger automotive manufacturers have adopted standardized tool tips; all manufacturers regardless of size should do so. We are told that in aircraft establishments, in particular, this program has turned out to be a life-saver. Consider another case, P. R. Mallory, well known metallurgical specialists, urged some years ago the adoption of a simplified line of standard welding electrode tips. Today this idea is clicking in the national defense program. In fact, its adoption may well aid in relieving any possible bottle-neck in the welding field.

Factory Transport

The role of the industrial truck in materials handling within the factory and for inter-departmental transportation is pretty well known. However, the current uses of this versatile equipment are so diverse that few people really know the whole story or can visualize its many possibilities. One of the dynamic producers of such equipment—the Automatic Transportation Co.—has made up a brochure on the uses of industrial trucks, featuring reprints of recent articles on the subject taken from the leading industrial publications. This book should be of value to everyone concerned with materials handling of every kind.

For Aircraft

How the use of light bench-type machines for drilling, sawing, filing, grinding, etc., has facilitated many tasks in aircraft establishments has been detailed in an interesting booklet by Walker-Turner. We might mention parenthetically that such types of tools have given a good account of themselves in the automotive industry, particularly in releasing the heavier machine tools for the major machine shop operations. An interesting result of the adoption of the bench-type machines such as are made by a number of other producers is the accumulation of service data indicating that the light equipment can really stand up in hard service and can give trouble-free performance for a long time.

On Substitutes

Metallurgists in many large plants are devoting considerable attention to finding suitable substitute materials and alloys to replace standard materials containing ingredients which may become unavailable in the near future. This problem deserves the close attention of every specialist in the field. The interesting thing about it is that as the laboratories are forced to study the situation intensively they are learning that some of the substitutes have hitherto unrevealed and desirable features. It simply goes to show that the old adage, "Tis an ill wind . . . etc.," still holds good. It also intimates that when the present emergency is out of the way—and we all hope that will be soon—some of the substitute materials will be very difficult to dislodge. And that points to a moral.

Improves Dies

An ingenious metallurgist spending his time in the press shop of a large plant has run across some interesting ideas. One with a lot of possibilities, to our mind, is that of Bonderizing die inserts on certain operations. As in the case of vehicle parts, this surface coating prevents scoring during the early use of the die, greatly increases the useful life of the die. And it's something that any press shop can try out.

Vetoes Hazard

We have just received a new booklet describing the current applications of Protectoseals for airplanes, for motor cars, for trucks, tractors, and buses, in fact for any place where gasoline is handled and stored. As most of us know, the Protectoseal is special self-contained gas filler attachment with fire-baffles and vapor-tight seals as the case may be. The device is made in a variety of types and forms to suit the specific application. And its safety features are assured through automatic means.—J. G.

BUSINESS IN BRIEF

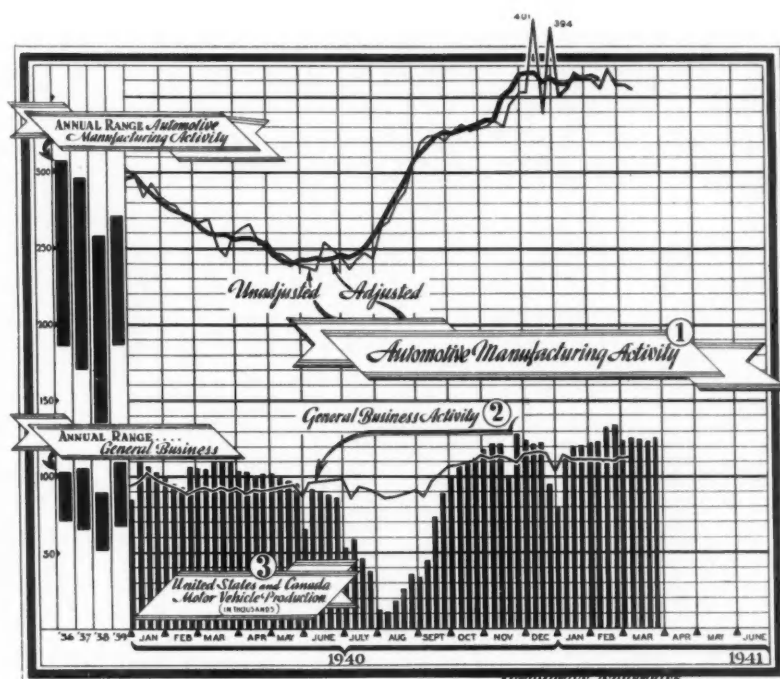
*Our own view of automotive production and sales;
authoritative interpretation of general conditions*

PASSING the three million mark on 1941 model production, March saw an output of an estimated 517,000 motor cars and trucks, a 15 per cent increase over the 440,232 units turned out in March, 1940. There was a possibility that March's total might go over 520,000 units and thus eclipse the 519,022 vehicles produced in the same month of 1937, which stands as the second highest March on record.

With one more working day, March output passed the February figure, but there was evidence that the high production level that has been maintained since the year-end holiday season was beginning to slacken a bit. Two of the largest volume producers reduced their schedules slightly to adjust their field stocks, which are abnormally large even for this time of year.

General Motors produced 54,600 units in the week ending March 22. Chevrolet has already assembled more than 800,000 of the 1941 models, while Buick is nearing the 250,000 mark in 1941 model production. Last year Chevrolet did not produce its 800,000th 1940 model until mid-May. Chrysler manufactured 26,800 vehicles during the week as several divisions curtailed operations slightly, while Ford accounted for 25,100 units, also a modest decrease. Studebaker headed the independents, followed by Nash, Hudson and Packard. Willys has been in production at variable intervals.

¹ 1923 average = 100; ² Prepared by Administrative and Research Corp. New York. 1926 = 100; ³ Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.



**Weekly indexes of automotive general business
charted**

1941 Model Output Over 3,000,000 Mark

per cent in aluminum and 50 per cent in zinc.

Retail deliveries continued to maintain record levels. Despite the short month, February retail sales totaled 420,221 units, according to the Automobile Manufacturers Association, the largest total for a single month since June, 1937, when 432,215 units were sold. The February figure was 48 per cent above February, 1940, and the biggest total for the month on record. Passenger car sales were 345,551 units, up 46 per cent from a year ago. Commercial vehicle sales of 74,670 units were 58 per cent ahead of February, 1940, and the biggest total for any month in the last 10 years.

Studebaker February sales of 8306 units were the biggest for the month on record and 11 per cent above 1940. Pontiac retail deliveries for the first two months of 1941 totaled 49,101 units, 73 per cent greater than the same period of 1940.

January new passenger car registrations reached a new all time high with 299,179 units.

Output was expected to rise slightly in the last week of March.

Automotive engineers are meeting the exigencies of the National Defense Program by developing adequate substitutes for strategic and critical materials in which a shortage exists. Government priorities on aluminum, magnesium and nickel and tight situations in zinc, stainless steel and tungsten have not hampered production. Ford technicians, for example, already have found means for saving 80 per cent in nickel, 50

NEWS OF THE INDUSTRY

Aircraft Standards Project Begins for Nation's Industry

OPM Assigns Engine, Propeller and Materials Work to SAE; Airplane Manufacturers' Group in Charge of Airframe Data

The Office of Production Management has assigned the Society of Automotive Engineers the responsibility for aeronautic standards work on aircraft engines, propellers, materials and processes, accessories and equipment. To meet the new demands, committee personnel has been increased. The chairman of the Aeronautics Division of the SAE Standards Committee is Arthur Nutt, past president of the Society and vice-president in charge of engineering of Wright Aeronautical Corp., John A. C. Warner, general manager, announced.

With Mr. Nutt the following are serving as members of this main division, which will direct and coordinate the various specific standards work of the various sub-committees:

Hall L. Hibbert, vice-president in charge of engineering, Lockheed Aircraft Corp., Burbank, Calif.; L. S. Hobbs, engineering manager, and Val Cronstedt, executive engineer, Pratt & Whitney division, United Aircraft Corp., East Hartford, Conn.; William Littlewood, vice-president in charge of engineering, American Airlines, Inc., New York; J. B. Johnson, U. S. Army Air Corps., Wright Field, Dayton; and

Erle Martin, engineering manager, Hamilton Standard Propellers, Inc., East Hartford.

The newly organized aeronautic standards division and subdivisions will replace the tentatively established SAE Aeronautical Standards Board for National Defense. The SAE work will be closely correlated with projects undertaken by the Aeronautical Chamber of Commerce, the Civil Aeronautics Administration, and the National Aircraft Standards Committee. The latter has been assigned the responsibility for standards work on airframes and the correlation of standards work in connection with powerplant installations.

Extrusion Die Pool

William M. Smith, of the Bell Aircraft Corp., Buffalo, is chairman of the National Aircraft Standards Committee, which is composed of representatives of the various aircraft manufacturers. Through the committee's efforts, the aviation industry has established pools of engineering information and has standardized, partially or wholly, such materials as rivets, bolts, screws, anchor nuts and hinges. A pool of 2500 extrusion dies, used in making

much of the "beneath the skin" structure in planes, also has been established by the aircraft companies.

Materials Data Available

The aircraft engine materials group of the SAE program, headed by B. Clements, metallurgist of Wright Aeronautical Corp., has already completed 136 aircraft materials specifications, more than 200,000 copies of which have been sold at cost to the aircraft, parts, and supplier industries. This group is accelerating its efforts toward completing of other needed materials specifications. Progress on Airframes Materials and Processes, being handled by a sub-division headed by L. D. Bonham, Lockheed Aircraft Corp., indicates rapid completion of a number of projects.

Based on work begun several years ago, the sub-division on aircraft engines, headed by Mr. Cronstedt, met in Washington on March 15 to lay plans for intensified work. A program of 20 specific subjects for immediate undertaking was approved, and the sub-committee organization was completed to carry out these projects. These sub-committees and their chairmen are:

Carburetor Installations: F. W. Wiegand, Wright Aeronautical Corp.

Drives for Engine Accessories: G. N. Cole, Pratt & Whitney division.

Magneto Mountings, Drives, Installations, and Distributors: E. K. Von Mertens, ignition project engineer, Pratt & Whitney division.

Spark Plugs, Radio Shielding, Ignition Cables: A. L. Beall, research engineer, Wright Aeronautical Corp.

Washers, Taper Pins, Standard Parts, Accessory Cover Plates, Rubber Hose: G. N. Cole, Pratt & Whitney Aircraft division.

Aircraft Screw Threads: G. Garvelli, Wright Aeronautical Corp.

Involute Splines: Mr. Garvelli.
Draughting Room Practice: J. G. Perrin, Pratt & Whitney Aircraft division.

Preservation of Engines (in storage): A. P. Ayers, Pratt & Whitney Aircraft division.

Surface Finishes: W. R. Griswold, chief research engineer, Packard Motor Car Co.

Engine Performance Presentation: E. Pierce, Wright Aeronautical Corp.

Accessories Committee

Mr. Littlewood's committee met March 7 in Dayton to launch the work on accessories and equipment standardization. Eleven sub-committees were formed to undertake the specific projects assigned them. These with their chairmen follow:

(Turn to page 398, please)

Uncle Sam's 12-Ton Tank

Off the assembly line of the American Car & Foundry Co. at Berwick, Pa., rolls the M2A4, a light 12-ton tank which has much military "oomph," according to the experts. U. S. Army Ordnance Dept. officials are shown inspecting it.



International

Canada Limits Output Of 1941 Passenger Cars

Production of passenger cars in Canada has been limited for the current year to 110,126 vehicles, the same number as were manufactured in 1940, according to recent announcement of Munitions Minister Howe in Ottawa. However, there is a possibility that the quota may be reduced even further. The quota system will be applied to Canadian manufacturers on the basis of 1940 output. Commercial vehicle production of 112,858 units, greatly stimulated by military orders, set a record for Canada in 1940. In a recent Toronto, interview, Munitions Minister Howe said that the quota system would keep production for sale to the public in check in order to conserve labor and materials for war production.

Excise and import taxes on passenger cars have been increased greatly since the war. Last summer the Canadian parliament set the following tax schedule on new passenger cars: 10 per cent on values up to \$700, 20 per cent on values from \$701 to \$900, 40 per cent on values from \$901 to \$1,200, and 80 per cent on values above \$1,200. This tax is almost prohibitive in the higher priced field, the taxes being based on the manufacturers' price. A \$1,000 car costs \$1,150 but one listing at \$4,000 costs \$6,270. The effect of the tax has been to enhance greatly the value of used cars in Canada.

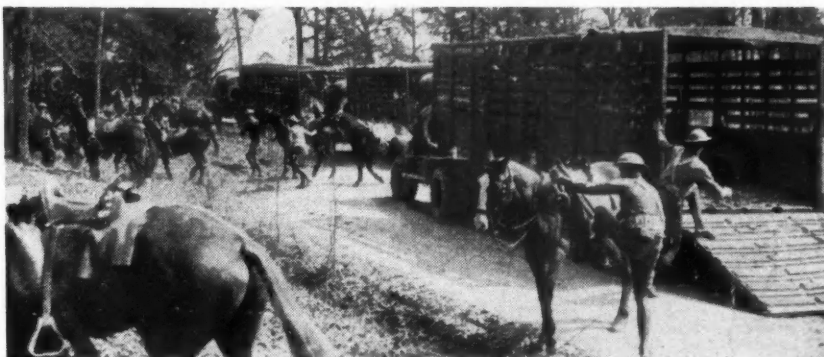
Machine Tool Forum Will Discuss Defense Problems

Production and design problems created by the National Defense emergency in the machine tool industry will be the principal topic of discussion when the Machine Tool Electrification Forum is held April 14-16 at the Westinghouse Electric & Mfg. Co., East Pittsburgh. Howard Dunbar, vice-president of the Norton Co. and a member of the Machine Tool Division of the National Defense Advisory Committee, will speak.

American Motorists Pay Big Tax Bill Each Year

Motor vehicle taxes averaged \$55.83 for each motor vehicle in operation last year in this country, the American Petroleum Industries Committee reports on the basis of preliminary reports now available. The \$2.66 increase in automotive tax cost over the \$53.17 for the preceding year resulted chiefly from the higher Federal automotive excise tax that took effect during the year. Gasoline taxes, State and Federal, accounted for about two-thirds of the total automotive tax bill. The committee estimates that 31,800,000 motor vehicles traveled over United States highways during 1940, an increase of 3½ per cent over the 30,615,087 vehicles in operation in 1939. The total motor tax for 1940 is estimated at \$1,775,515,000 and for 1939 at \$1,627,745,000.

Automotive Industries



Acme

Mechanized Cavalry Tactics

Uncle Sam's fast growing mechanized army includes motorized vans to rush cavalry horses to advance positions. These men have just taken their mounts from vans during exercises at Fort Oglethorpe in Georgia.

Widespread Labor Disputes Keep Federal Agents Busy

Strikes Threaten to Retard Defense Production; Industrial Employment Rises Fast and Government Searches for Workers

Although industrial employment indices reached new peaks, some of them surpassing 1929 figures, strikes continued to interrupt the U. S. production scene during March, many of them in vital defense plants. Labor troubles kept representatives of the OPM and U. S. conciliation service on the jump as they hopped from one part of the country to another in an effort to bring about settlements.

Factory employment in the Detroit area reached 422,000 workers on March 15, the highest total since October, 1937, and a 12 per cent gain over the same date of 1940. Cleveland's industrial index reached the highest point in its 20-year history during February with a mark of 114.1 compared to 112.9 in August, 1929, the former peak. Toledo factory rolls reached 23,637 workers March 15, the highest since 1937. At Windsor, Ont., site of many Canadian automotive plants engaged in war orders, employment totaled 29,486 workers, 24 per cent above the previous peak set in April, 1929.

In the national drive by the OPM to obtain workers for defense, 12,056 unemployed had registered the first week. The active files of the Michigan Unemployment Compensation Commission showed 148,123 on the unemployed rolls as of March 1, but only 18,000 were listed as skilled or semi-skilled. Detroit's welfare case load was at its lowest point since June, 1937.

Ford Hearing

Hearing on the petition with the NLRB for an election in the Ford Motor Co. Rouge and Lincoln plants was begun March 24 in Detroit. Charging that the UAW-CIO and the Detroit NLRB office are dominated by Communists, I. A. Capizzi, Ford attorney,

asked that the petition be dismissed or at least transferred to another NLRB district free from Communist influence. Capizzi said the petition was part of a Communist plot to gain control of the Ford Motor Co. and cripple national defense.

Meanwhile, the Ford Lincoln plant closed down March 24 due to a strike at the Midland Steel Products Co., Detroit. Several Chrysler and General Motors divisions which, like Lincoln, depend upon Midland for automobile frames, also were expected to close down in a few days if the strike was not settled. The strike was called March 10 by the UAW-CIO.

Strike at General Motors Plants

Despite a warning by Carl A. Swanson, UAW-CIO Regional Director at Flint, that there must be no "wildcat" strikes while negotiations for a new contract with General Motors are in progress, a strike developed at four General Motors plants at Oakland, Cal., on March 18. A welder was discharged in the Oakland Fisher body plant in a dispute over a speedup charge, and this resulted in an unauthorized walk-out by 26 men, who were fired for violation of the contract. Members of the union then authorized the strike, which made more than 3000 men idle and halted production of Army trucks.

Supported by the AFL and guarded by 1400 policemen, the International Harvester Co. reopened its big Chicago McCormick works March 24. The plant, which employs 6000 men, had been closed since February. The FEWOC previously had closed the International Chicago Tractor, Rock Falls, Ill., and Richmond, Ind., plants by strikes, seeking wage increases and union recognition.

April 1, 1941

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES

General business activity is maintained at levels close to the recently attained peak. The unadjusted index of *The Journal of Commerce* for the week ended March 8 stood at 117.7 per cent of the 1927-29 average, as compared with the record high of 117.9 for the preceding week. The seasonally adjusted index of *The New York Times* for the same period fell back to 121.5 per cent of the estimated normal, as against 122.6 for the preceding week and 100.1 a year ago.

Department store sales during the week ended March 8 were unchanged from the level reported a year ago, according to the Federal Reserve compilation. For the year to that date, the gain over comparable 1940 sales was 10 per cent.

Bank debits to deposit accounts, except inter-bank accounts, in leading cities during the week ended March 12 were six per cent greater than a year ago. The total for the 13-week period ended on that date was 11 per cent above that a year earlier.

The movement of railway freight during the week ended March 8 declined more than seasonally. Loadings totaled 741,922 cars, 1.9 per cent fewer than for the preceding week but 19.5 per cent more than in the corresponding period last year.

Electric power production in the same week rose contra-seasonally to a level 15.1 per cent above that a year ago; the similar gain for the week before was 14.0 per cent.

Business failures for the week ended

March 13 numbered 268, according to the Dun & Bradstreet report, as against 241 during the preceding week and 354 in the corresponding period last year.

Crude oil production in the week ended March 15 averaged 3,662,450 barrels daily, 29,000 barrels above the average for the week before, but 3,050 barrels less than the currently required output as computed by the Bureau of Mines.

Average daily output of bituminous coal during the week ended March 8 was 1,783,000 tons, as compared with 1,794,000 tons in the preceding week and 1,378,000 tons a year ago.

Cotton mill activity in the same period advanced more than seasonally. The *New York Times* adjusted index rose to 148.8 per cent of the estimated normal, as against 148.0 for the week before and 116.6 a year ago.

Professor Fisher's index of wholesale commodity prices for the second week of March rose to 86.6 per cent of the 1926 average, a new peak for this year and the highest level recorded since November, 1937. The figure for the preceding week was 85.9.

Member bank reserve balances increased \$75,000,000 during the week ended March 12, and estimated excess reserves rose \$40,000,000 to a total of \$6,480,000,000. Business loans of the reporting members increased \$87,000,000 and stood at \$5,374,000,000, exceeding by more than a billion dollars the comparable total a year ago.

Urge Dealers to Begin Training of Mechanics

To help automobile dealers meet the impending shortage of mechanics, educational programs have been instituted by the National Automobile Dealers Association and the Automotive Trade Association Managers. The former has issued a presentation that outlines the problems and suggests methods by which new mechanics can be trained. In this connection President L. Clare Cargile of the NADA has urged every dealer to consider this problem immediately from the standpoint of taking prompt action.

To start its part of the mechanics' training program, the Automotive Trade Association Managers has organized a committee which held its initial meeting on March 22 in Chicago with NADA President Cargile in attendance. The committee appointed by W. A. Williamson, ATAM president and vice president of the Texas Automotive Dealers Association, comprises the following members: R. Earl Burrows, manager of the Cleveland Automotive Trade Association, chairman; Paul T. Graves, manager, Detroit Auto Dealers Association; and J. A. Schlecht, secretary-manager, Greater St. Louis Automotive Association. Samuel B. Shapiro, general manager of the Chicago Automobile Trade Association, is an ex-officio member of the committee in his capacity as secretary-treasurer of the ATAM.

Producers Direct Efforts to Control Flow of Steel

Defense Needs to Be Met First with Rationing of Remaining Supply to Maintain Economic Stability; Book Only For 1941

By W. C. Hirsch

Steel producers are striving with might and main to so perfect their system of control over the flow of steel into consumption channels that defense needs will be met to the fullest extent possible, and that what remains then for allotment will be distributed with a view to conserving the country's normal economic set-up. As a first step to that end, a large independent steel company has advised the trade that it will book no orders that can not be filled and shipped this year. When its first quarter, 1942, order books are opened and deductions for national defense requirements in that period have been made, prospective production will be apportioned according to individual customers' normal purchase records. A number of other steel companies are reported to be following the same plan.

With more and more evidence piling up that altogether too many customers were indulging in protective buying and falling over one another to get on order books for tonnages they would not need before six and even nine months, when

formerly they never anticipated their requirements by more than that many weeks, the steel industry faced the problem of taking drastic measures to curb this tendency or to play into the hands of those who advocate rigid priority rules by the defense authorities.

Operation Near Capacity

Although operations in the final March week, according to the American Iron & Steel Institute, were at 99.8 per cent of ingot capacity, with finishing mills in some instances employing upwards of 90 per cent of their capacity, lessening of the pressure is now looked for to make itself felt in the near future. A gradual tapering off in automobile manufacturers' releases for steel for their passenger car assembly schedules is expected before long to synchronize with enlarged use of sheet mills for the rolling of light plate to be used in defense material. Unless steel producers' costs should be sharply lifted as a result of higher

(Turn to page 396, please)

CALENDAR

Conventions and Meetings

American Chemical Society, St. Louis,	Apr. 7-11
Midwest Power Conference Chicago,	April 9-10
Chamber of Commerce of the U.S.A., Annual Meeting, Washington, D.C.,	Apr. 29-May 1
American Gear Mfg. Assoc., Hot Springs, W. Va.	May 5-7
National Metal Trades Assoc., Chicago,	May 8-9
American Foundrymen's Assoc., New York	May 12-15
Western Metal Exposition and Congress, Los Angeles	May 19-23
American Iron & Steel Institute, New York	May 22
American Battery Manufacturers Assoc., Detroit	May 22-23
Society of Automotive Engineers, Summer Meeting, White Sulphur Springs, W. Va.	June 1-6
Eastern Photoelasticity Conference, Cambridge, Mass.	June 12-14
American Society for Testing Materials, Annual Meeting, Chicago	June 23-27
Society of Automotive Engineers, National Tractor Meeting, Milwaukee,	Sept. 25-26
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles	Oct. 30-Nov. 1

Shows

Automotive Trade & Accessories Show, Boston	May 1
Automobile Accessories Association Show, Chicago	Aug. 4-7

April 1, 1941

Automotive Industries

40 YEARS AGO

Although the Sultan of Turkey has joined the ranks of automobilists, he does not care to trust his person to his machine; for the present he finds sufficient pleasure in looking on while two officers maneuver it in front of his window.

* * *

The latest means to protect pneumatic tires against punctures, which is the invention of a Count Valdelagrana, consists in fixing rotary street sweepers just ahead of the wheels to brush aside any nails or sharp objects.

* * *

Aldermen of Macon, Ga., would limit the speed of automobiles in that city to eight miles an hour.

* * *

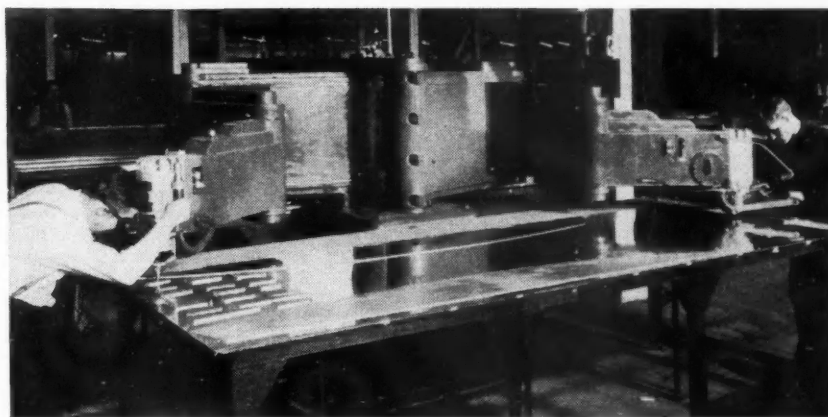
The factory of the Olds Motor Works, Detroit, was almost entirely destroyed by fire on March 9. The loss is said to reach \$60,000. The company plans to secure another building and will make all possible haste to fill orders for the light gasoline "Oldsmobile."

From *Horseless Age*, March, 1901.

Buick and G.M. Truck Add Plant Facilities

Construction projects to be undertaken by the Buick Division of General Motors at Flint include a salvage factory, an addition to the final assembly line building, and a factory building to house new car servicing and shipping facilities. The salvage factory, which will be adjacent to the engine, gear and axle plants, will have 2700 sq. ft. of floor space with special machinery and equipment for reclaiming excess material from the three factories it serves, such as metal borings, chips, and the like. The final assembly line is to be lengthened 240 feet and the extension of its building will result in the addition of about 15,000 sq. ft. of floor space. The largest construction project on Buick's current program is the new car servicing and shipping building, which will provide 450,000 sq. ft. of floor space for servicing cars as they leave the final assembly line and for preparing them for shipment.

General Motors Truck & Coach Division of Yellow Truck & Coach Mfg. Co. is pushing to completion at Pontiac, Mich., the fourth of a series of plant additions made necessary by the division's participation in the National Defense program. GM Truck has received defense orders for U. S. Army trucks of all types totaling more than \$86,000,000 and is turning out more than 1000 trucks weekly. The latest plant addition is a one-story building, 481 by 80 feet and containing 40,000 sq. ft., which will be used for final inspection and adjustment of Government trucks. Cost is approximately \$100,000. Present employment is over the 10,000 mark compared to 5332 a year ago.



Hudson Speeds Warplane Production

This huge machine in the aircraft division of the Hudson Motor Car Co. in Detroit is a combination radial arm router and drill. Sheets in multiple can be cut and drilled in one operation. It eliminates the necessity for blanking dies.

Studebaker Statement

Decline of the consolidated net profit of the Studebaker Corp. from \$2,923,251 in 1939 to \$2,124,628 for 1940 is attributed to increased material and manufacturing costs, and higher taxes in the annual report to the stockholders. During 1940 the corporation sold 119,509 passenger cars and trucks, and the net sales amounted to \$84,164,224. In the preceding year 114,196 units were sold and the net sales totaled \$81,719,106.

February Rubber Stocks

Total domestic stocks of rubber at the end of February in United States amounted to 353,733 long tons, an increase of 3.8 per cent over the stocks at the end of January and 163 per cent higher than at the end of February, 1940. During February U. S. rubber manufacturers consumed 61,016 long tons of crude rubber, or five per cent below January and over 22 per cent more than in February of the previous year.

Exports and Imports of the Automotive Industry for January

	JANUARY, 1940		JANUARY, 1941	
	Number	Value	Number	Value
EXPORTS				
Automobiles, parts and accessories.....		\$23,735,894		\$25,378,638
PASSENGER CARS				
Passenger cars and chassis.....	13,334	7,812,328	7,030	4,875,125
Low price range \$850 inclusive.....	11,915	6,370,614	5,534	3,275,907
Medium price range over \$850 to \$1200.....	1,261	1,193,999	1,224	1,196,472
1200 to \$2000.....	143	207,270	260	372,966
Over \$2000.....	15	40,435	12	29,780
COMMERCIAL VEHICLES				
Motor trucks, buses and chassis (total).....	9,538	6,211,018	8,650	6,202,388
Under one ton.....	1,555	646,446	741	368,357
One and up to 1½ tons.....	6,697	3,495,936	5,689	4,066,755
Over 1½ tons to 2½ tons.....	972	1,192,510	900	1,148,710
Over 2½ tons.....	311	873,191	1,313	2,610,389
Bus chassis.....	3	2,935	7	8,177
PARTS, ETC.				
Parts, except engines and tires.....		5,132,679		6,941,268
Automobile unit assemblies.....		3,180,913		3,759,644
Automobile parts for replacement (n.e.s.).....		349,139		549,215
Other automobile accessories.....		284,145		241,871
Automobile service appliances.....		16,558,409		25,488,373
Airplanes, seaplanes and other aircraft (powered).....	206	2,597,439	450	2,441,994
Parts of airplanes, except engines and tires (n.e.s.).....				
INTERNAL COMBUSTION ENGINES				
Stationary and Portable.....				
Diesel and semi-Diesel (other than automotive).....	71	188,862	4	52,420
Other stationary and portable:				
Not over 10 hp.....	1,189	670,807	1,156	82,153
Over 10 hp.....	299	170,717	119	140,696
Engines for:				
Motor trucks and buses.....	2,452	291,762	2,596	390,429
Passenger cars.....	2,681	223,015	1,210	140,257
Aircraft.....	364	3,314,150	514	5,710,002
Accessories and parts (carburetors).....		283,162		381,779
IMPORTS				
Automobiles (durable).....	56	68,869	23	22,691



Ford Bomb Trucks

Bomb service trucks, made by Ford, are a familiar piece of equipment these days at U. S. Army air bases. Rigged with derrick and windlass, they haul bombs weighing 600 to 1200 lbs. The above bomb is a 600-pounder.

Air Defense Committee Completes Its Program

Detroit Automotive Group on Army Bomber Project Disbands; Amortization Awards and Additional Defense Orders Listed

Having fulfilled its mission of assisting in the allocation of the U. S. Army bomber procurement program to the automotive industry, the Automotive Committee for Air Defense has been disbanded. Clarence C. Carlton, the director, is returning to his position of executive vice-president of Motor Wheel Corp.; William J. Cronin, assistant director, has gone back to the AMA, and W. F. DeGroat, technical advisor, has joined the Ford Motor Co. aircraft engineering staff. The display of bomber assemblies and parts in the committee's exhibit at the Graham-Paige plant in Dearborn is being distributed to the companies which will manufacture them.

Seven hundred and fifty questionnaires detailing manufacturing facilities available from the 1900 representatives of 1067 companies that visited the exhibit have been filed with U. S. Army Air Corps for reference in obtaining subcontractors. Suppliers, who wish to furnish parts for the consolidated B-24D airframe, will contact the Ford purchasing department. C. M. Crusoe, purchasing agent of the Fisher Body Division of GM, will be the key man on parts for the North American B-25 bomber, while the Martin B-26 airframe parts are to be supplied by three main subcontractors. Chrysler Corp. will turn out the fore and mid-fuselage sections in space leased at the Graham-Paige plant. Goodyear Aircraft Corp. will fabricate the complete wings and tail surfaces at Akron, Ohio, while Hudson Motor Car Co. will make the aft section of the fuselage.

Authorize Plant Costs

Ford already has received a letter from the Government of the intent to spend \$10,988,682 for construction of the plant near Ypsilanti, Mich., to manufacture bomber subassemblies, along with an educational order for \$3,200,000 for bomber parts. Fisher Body has accepted a letter of intent

for \$6,875,000 to expand its Memphis, Tenn., plant, previously used for wood-working, as a subassembly center for bomber parts made by other Fisher Body plants at Detroit and Cleveland. Of the amount, \$4,475,000 will be for machinery and the rest for additional buildings.

Bomber parts made at all these plants will be shipped to Government-financed and aircraft company-operated plants at Fort Worth, Tex., Tulsa, Okla., Kansas City, Kan., and Omaha, Neb., for final assembly. A Government appropriation in excess of \$1,000,000,000 has been approved in Congress to finance the Army program of 3600 heavy and medium bombers and the four assembly plants.

The Hudson Motor Car Co. is to be—
(Turn to page 398, please)

New Board Will Assist In Labor Negotiations

Established under the Office for Emergency Management, the new defense mediation board under the terms of the Executive Order signed by the President will handle any dispute which "threatens to burden or obstruct the production or transportation of equipment or materials essential to national defense" and which cannot be adjusted by the Labor Department's conciliation service.

After the Secretary of Labor has certified a dispute to the board, the 11-man agency will attempt settlement by aiding in the negotiations. Members named to the board include:

Representing the public—Clarence A. Dykstra, president, University of Wisconsin; William Hammatt, New York patent attorney; and Frank P. Graham, president, University of North Carolina.

Representing employees—George Meany, AFL general secretary; George M. Harrison, president, Brotherhood of Railway and Steamship Clerks; Philip Murray, SWOC chairman; Thomas Kennedy, vice-president, United Mine Workers of America.

Representing employers—Walter C. Teagle, former president, Standard Oil Co. of New Jersey; Roger D. Lapham, president, American Hawaiian Steamship Co.; Eugene Meyer, publisher of the Washington Post; Cyrus Ching, vice-president, U. S. Rubber Corp.

Allegheny Ludlum Earnings

The consolidated net income of the Allegheny Ludlum Steel Corp., Pittsburgh, was \$3,722,107 in 1940 as compared with \$2,093,518 in 1939, the annual report of the company states.

New Passenger Car Registrations*

	January		January	Per Cent Change January 1941 Over 1940	Per Cent of Total January		Four Months Model Year		
	1941	December 1940	1940		1941	1940	1941	1940	Per Cent Change
Chevrolet.....	71,151	88,195	65,945	+ 8.0	23.78	25.34	303,046	215,530	+ 41.0
Ford.....	52,088	52,810	42,824	+ 21.6	17.41	16.46	195,071	168,614	+ 15.8
Plymouth.....	35,219	37,621	32,987	+ 6.8	11.77	12.68	151,809	99,200	+ 53.0
Buick.....	26,273	28,758	23,108	+ 3.5	8.78	8.88	115,255	98,078	+ 17.7
Pontiac.....	22,346	25,143	16,203	+ 37.7	7.47	6.23	93,882	66,632	+ 41.0
Oldsmobile.....	19,247	21,740	14,141	+ 36.5	6.43	5.43	79,501	60,906	+ 30.4
Dodge.....	16,661	17,584	16,514	+ 1.0	5.57	6.35	60,303	43,633	+ 38.0
Chrysler.....	10,801	11,421	7,374	+ 46.6	3.61	2.83	38,401	19,435	+ 98.0
Studebaker.....	7,991	8,747	7,147	+ 12.0	2.68	2.75	34,908	32,886	+ 6.1
Mercury.....	7,061	7,840	6,734	+ 5.0	2.36	2.59	26,656	25,184	+ 6.0
De Soto.....	6,132	6,997	5,137	+ 19.4	2.05	1.97	24,051	14,797	+ 62.1
Nash.....	5,607	6,164	4,335	+ 29.3	1.88	1.67	18,732	18,239	+ 3.0
Hudson.....	5,423	6,227	5,737	+ 5.4	1.81	2.20	25,752	30,319	- 15.0
Cadillac.....	5,145	5,360	2,885	+ 78.0	1.72	1.11	19,024	13,334	+ 42.5
Packard.....	4,496	5,678	5,271	+ 14.7	1.50	2.03	23,033	28,384	- 18.8
Lincoln.....	1,639	1,817	2,008	- 18.2	.55	.77	7,102	7,305	- 2.8
Willys-Amercar.....	1,488	1,645	1,678	- 9.5	.50	.64	6,334	7,466	- 15.2
Graham.....	133	150	36	+270.0	.04	.01	664	266	+132.0
Crosley.....	42	32	51	- 17.7	.01	.02	153	209	- 26.7
Bantam.....	25	26	78	- 67.9	.01	.03	124	330	- 62.4
Hupmobile.....	9	32	8	+ 12.5	.....	.....	127	48	+185.0
Miscellaneous.....	202	86	15	.....	.07	.01	1,230	102	+815.0
Total.....	299,179	334,073	260,216	+ 15.0	100.00	100.00	1,225,177	950,917	+ 28.6
Chrysler Corporation.....	68,813	73,623	62,012	+ 11.0	23.00	23.83	274,573	177,065	+ 55.0
Ford Motors.....	60,788	62,467	51,566	+ 18.0	20.32	19.82	228,829	201,103	+ 14.0
General Motors Corp.....	144,162	169,196	122,282	+ 17.9	48.18	46.99	610,718	454,480	+ 34.5
All Others.....	25,416	28,787	24,356	+ 4.3	8.50	9.36	111,057	118,269	- 6.1

* Includes Federal Government deliveries.

MEN

Cardox Corp., Chicago, announces the following executive appointments: **J. H. Bell**, executive vice-president; **Eric Geertz**, vice-president, Fire Division; **Herbert W. Lange**, chief engineer, Fire Division; **Harry Ensminger**, general sales manager, Fire Division; **Lawrence E. Lawson**, vice-president, Carbon Dioxide Division, and **Dr. C. A. Getz**, director of research.

Harry C. Crawford, for the past 20 years associated with the Thompson Products Co., has been elected vice-president of the International Piston Ring Co., Cleveland.

W. Houlton Blankley has been appointed district sales manager of the accessories division of the Stewart-Warner Corp.

Paul Helms became purchasing agent of the Roller-Smith Co., Bethlehem, Pa., on April 1, succeeding **Harry A. Cassler**, who held that position for the past 20 years. Mr. Helms formerly was assistant purchasing agent.

D. C. Gaskin has been appointed vice-president and general manager of the Studebaker Corp. of Canada, Ltd., Walkerville, Ont. He succeeds **M. S. Brooks**, who was transferred recently to an executive position with the Studebaker organization at South Bend.

D. W. Lee has been appointed sales engineer of the truck division, Dodge Bros.

M. E. Coyle, vice-president of General Motors and general manager of Chevrolet, was the guest of honor at a dinner gathering recently in Detroit celebrating the 25th anniversary of his association with Chevrolet.

J. L. Stewart, of Toronto, Ont., general manager of the Canadian Automobile Chamber of Commerce, has been appointed deputy oil controller of Canada.

J. L. Koubek has been promoted to sales manager of the Guide Lamp Division of the General Motor Corp. His assistants are **John Hughel** and **S. R. Conwell**, the former in charge of the home sales office at Anderson, Ind., and the latter in charge of the Detroit sales office.

Bendix-Westinghouse Automotive Air Brake Co. announces the appointment of **D. R. Brehm** as district manager in charge of the company's new St. Louis office. He will be assisted by **Paul J. Kuffner**.

Corles G. Keyes, Keyes Supply Co., Ltd., Ottawa, Ont., has been named to represent the Canadian members on the Board of Directors of the Motor & Equipment Wholesalers Association.

Chicago Metal Hose Co. has announced the promotion of **A. S. Keller** to vice-president in charge of sales, **A. E. F. Johnson** to vice-president in charge of production, and **D. Wendell Fentress** to vice-president in charge of special technical developments.

Election of **John L. McQuigg** as vice president of Geyer, Cornell & Newell, Inc., national advertising agency of New York City and Detroit, and manager of the Detroit branch of the agency, is announced by **B. B. Geyer**, president.

Buick Motor Division of GM has made the following manufacturing appointments to fill prior vacancies: **F. W. Moore**, chief of tool manufacture; **Homer Schultz**, assistant master mechanic; **A. A. Miller**, assistant works engineer; **Waldemar Velguth**, assistant chief metallurgist; **Roland G. Thomas**, assistant chief inspector, and **John E. Weckler**, assistant foundry superintendent.

Donaldson Brown, vice chairman of General Motors Corp., has been appointed to the Committee on National Defense of the National Association of Manufacturers.

Charles P. Colpitts, of New York, has been elected a director of the Autocar Corp., succeeding **Wallace Groves**, resigned.

Millard E. Price has been named to the new position of controller of Thompson Products, Inc., Cleveland.

R. H. Daisley, vice president in charge of the Wilcox-Rich Division, has been elected a director of the Eaton Mfg. Co., succeeding **E. E. Swartswelter**.

Slosh Tester

This ponderous device is used by **B. F. Goodrich Co.** to test self-sealing tanks for warplanes. A 425-gallon tank has just been rocked at 16 to 18 cycles per minute for 25 hours to determine the effect of the sloshing fuel.



Priority Ruling Extends to Industrial Products

OPM Announces List of Critical Items; Munitions Board to Assign Preference Ratings to Army and Navy Contracts

A long list of products used and made by the automotive industries are included in the defense priority critical list made public on March 18 by OPM Director of Priorities **Edward R. Stettinius, Jr.** In issuing the list, Director Stettinius announced his first administrative order based upon a formal plan providing for operation of the priorities system by the OPM and the Army and Navy Munitions Board.

One of the major changes provided in the formal plan is that the Army and Navy Munitions Board will now administer the assignment of preference ratings to Army and Navy orders, not only for prime contracts but also for all other subcontracts for critical list items entering into such orders. The OPM Priorities Division will continue to handle directly the assignment of ratings for items not on the critical list, for important civilian projects and the priority actions for the allocation of certain materials which must be handled on an industry-wide basis.

Among the items of interest to the automotive industries which have been placed on the critical list are the following:

Roller and ball bearings; pig and fabricated brass; chromium alloy steel; combat vehicles; service coils; automatic control equipment for electric motors; cranes; diamond point tools; diamond forging dies; electric generators, motors and motor generators, dynamometers, except NEMA standard types, meeting AIEE specifications and rules; brass, steel and aluminum forgings; power-driven hammers; jigs and fixtures; machine and metal working tools; power-driven machinery of various types; pig or fabricated magnesium and alloys; monel metal; solo or side car motorcycles (service types); pig or fabricated nickel; alloy steel nickel; synthetic rubber; electric steel; tanks; tin; precision hand tools; military trac-

tors; trailers; electric transformers; motor trucks (all special service types); ferro tungsten and tungsten ore; tungsten alloy steel; vanadium and vanadium alloys; vehicles (service types); and zinc.

BOOKS

ANALYTICAL DESIGN OF HIGH SPEED INTERNAL COMBUSTION ENGINES, by **F. M. Cousins**, Consulting Engineer. Published by Pitman Publishing Corporation, New York and Chicago.

As information relating to internal combustion engines has accumulated, authors of textbooks on this type of engine have shown an inclination to specialize, addressing themselves more or less exclusively either to those who design the engines, those who test them, or those who operate and maintain them. The greatest of these fields, so far as available information is concerned, is undoubtedly that which interests the designer, and here there has been a tendency toward further specialization. Many of the problems which confront the designer, especially in these days of high-speed engines, are of a mathematical nature, and most of the larger organizations producing internal combustion engines have in their engineering staffs at least one man who is familiar with the problems of stresses, unbalanced forces and vibration in these engines.

The author of the book under review, who is at present technical engineer for the International Harvester Co. and formerly held a similar position with the Packard Motor Car Co., has produced a well-rounded treatise on the mathematical problems of engine design. It goes into these problems more extensively than any other single treatise of which we know. Aside from brief chapters on Engine Thermodynamics, Design of Crankshaft Bearings, and Firing Orders, the subjects dealt with in the book are as follows: mechanical balance of engines, including the inline, V and radial types; kinetic energy of moving parts, crankshaft torque, offset engines, torsional and transverse crankshaft vibration, flywheel design, cam design, harmonic analysis, crankshaft stresses and strains.

CENSORED

An exclusive feature prepared by the London correspondent of **AUTOMOTIVE INDUSTRIES**, M. W. Bourdon.

The Government has taken definite action to increase the supplies of new trucks and spare parts for civilian use. Supplies of vehicles for military service are stated to be sufficiently satisfactory to permit a proportion, about 10 per cent of the output of the industry as a whole, to be diverted to meet civilian transport requirements.

* * *

An increased output of battery-electric trucks has been authorized for civilian transport. More steel and other materials have been allocated for this purpose, though the output will still be far below peace time production figures.

* * *

An appeal has been issued by the Minister of Supply to owners of private passenger cars of 20 hp. and over, not more than three years old to offer them for sale direct to the Government for what is described as "a special Army requirement." Payment is promised at the original list price less 10 per cent per annum for depreciation.

* * *

Dr. Hele-Shaw, whose death has occurred at the age of 86 years, was a pioneer of road transport by motor vehicles. He was the inventor nearly 40 years ago of the Hele-Shaw multi-plate clutch, and its introduction eventually led to the cone clutch being superseded by the single-plate type. He was a past-president of the Institution of Automobile Engineers and, as chairman of the Self-Propelled Traffic Association in 1897, organized the first competitive truck trial held in England.

STEEL

(Continued from page 392)

wage concessions, current prices are expected to continue in effect.

Establishment of maximum selling prices for aluminum scrap and for secondary aluminum ingot and alloys by the National Defense Advisory Commission's price stabilization division was almost generally welcomed in the market as decidedly clearing the atmosphere. Although under normal conditions one of the most important sources of aluminum scrap, automotive manufacturers have never permitted the vagaries of the market for this by-product to affect their system for disposing of accumulations. When accumulations justified it, bids were invited, the market's future being left to the purchasing dealer or remelter to

worry about. Quite a little remelted aluminum has been going into automobile accessories. With the tendency to use as much as possible other materials, until the stringency in the supply of aluminum as the result of defense needs has been overcome, the prices set as maximum for secondary aluminum ingot are of more interest than importance to automobile manufacturers and parts makers. Announcement that similar price regulations were imminent in zinc scrap as well as in iron and steel scrap caused little surprise. In the supply of both, the automotive industries are an important factor.

Extension of prevailing export quotas for another six months was decreed at a meeting of the International Tin Committee in London. The price of tin continues substantially above that paid by the Government's Metals Reserve Company. It must be remembered, however, that the London tin market continues to be one of the few free commodity markets left, and that ups and downs there have their repercussions here.

Aluminum Scrap Prices

The new price schedule of the price stabilization division of the National Defense Advisory Commission establishes two ceiling prices for aluminum scrap. The lower ceiling applies to the first sale of aluminum scrap from the maker to any other person. The higher ceiling applies to any sale of aluminum

scrap thereafter by any dealer or other person to any smelter, foundryman, fabricator, or other dealer. The two ceilings, fixed f.o.b. the point of shipment, will allow the dealer a margin of 1½ cents per lb. on clippings, borings and turnings, and one cent per lb. on other types of aluminum scrap.

The maximum prices for secondary aluminum ingot, also made f.o.b. the point of shipment, are applicable to any sale or purchase of secondary aluminum ingot by any person. These prices, which leave a spread of three to four cents per lb. for the processors' costs and profits, were expected by government officials to give ample allowance for reasonable profit to both dealers and smelters.

General Motors in 1940

In its annual report General Motors Corp. reports a net income of \$195,621,721 and net sales of \$1,794,936,642 for 1940. The net sales figure is the highest in the history of the corporation. The net income in 1939 was \$183,290,222.

Passenger cars and trucks manufactured in the General Motors plants in United States and Canada totaled 2,025,343 units, an increase of 31 per cent.

A recent report sent to the stockholders stated that General Motors orders under the National Defense program amount to \$683,400,000.

Estimated Dealer Stocks of New Passenger Cars

1940	January	February	March	April	May	June
Production—U. S. Domestic Market †.....	348,755	324,555	341,634	351,814	315,441	276,949
Retail Sales—U. S. ‡.....	239,509	236,857	338,153	353,433	330,521	350,871
Change in Inventory.....	+109,246	+87,698	+3,481	-1,609	-15,080	-73,922
Inventory, First of Month.....	215,856	325,102	412,800	416,281	414,672	399,592
1940 (continued)	July	August	September	October	November	December
Production—U. S. Domestic Market †.....	165,672	45,172	220,696	411,016	395,860	386,729
Retail Sales—U. S. ‡.....	298,683	177,679	158,083	326,097	334,536	319,187
Change in Inventory.....	-133,011	-132,507	+62,613	+84,919	+61,324	+67,542
Inventory, First of Month.....	325,670	192,659	60,152	122,765	207,684	269,008
1941	January	February	March	April	May	June
Production—U. S. Domestic Market †.....	401,799	.....	.....	.....	.....	.....
Retail Sales—U. S. ‡.....	303,554	.....	.....	.....	.....	.....
Change in Inventory.....	+98,235	.....	.....	.....	.....	.....
Inventory, First of Month.....	336,550	434,785	.....	.....	.....	.....

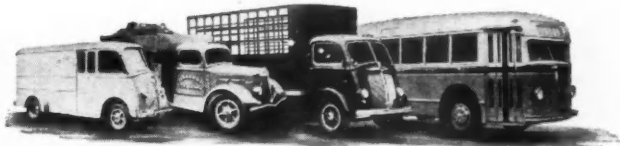
†—U. S. Census Bureau.

‡—Automobile Manufacturers Association.

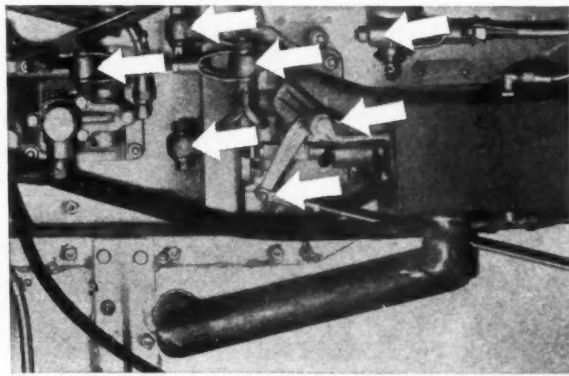
Truck Production by Capacities (U. S. and Canada)

	JANUARY				
	Units			Per Cent of Total	
	1941	1940	Per Cent Change	1941	1940
1½ Tons and less.....	88,606	65,935	+ 34.6	87.84	89.08
2 to 3 Tons.....	8,428	5,113	+ 65.0	8.35	6.91
3½ Tons and over.....	1,555	1,015	+ 53.0	1.54	1.37
Special and buses.....	795	479	+ 66.1	.79	.65
Station Wagons.....	1,494	1,474	+ 1.3	1.48	1.99
Total.....	100,878	74,016	+ 35.0	100.00	100.00

TORRINGTON NEEDLE BEARINGS INCREASE EFFICIENCY, REDUCE COSTS ON WHITE SUPER POWER TRUCKS, BUSES, AND FAMOUS WHITE HORSE



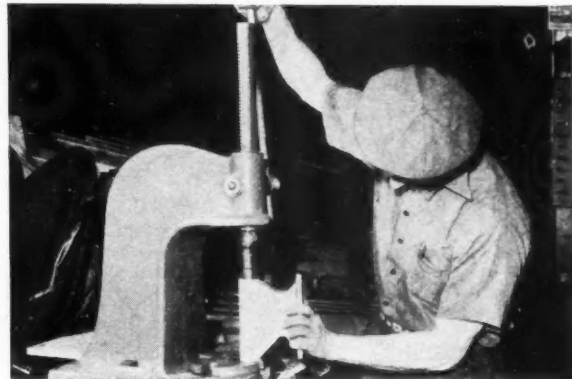
1 ANTI-FRICTION TORRINGTON NEEDLE BEARINGS are widely used in the construction of White Super Power Trucks and Buses because they withstand heavy loads, provide anti-friction operation in small space. Radial load capacity is unusually high in proportion to the size of the Needle Bearings.



2 UNDER SIDE OF WHITE BUS reveals 7 Torrington Needle Bearings on controls. Their anti-friction qualities allow utmost freedom in movement of levers, rods and arms and permit long control rods to move freely without binding. Photo shows how easily bearings fit in limited area.

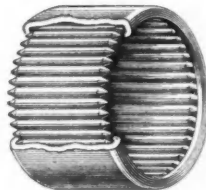


3 NEEDLE BEARINGS are utilized on folding door of White Horse quick-delivery truck. They permit doors to operate freely in any weather. No extra lubrication system is necessary as the bearings store large supplies of oil or grease. Because Needle Bearings last longer, maintenance is substantially diminished.



4 INSTALLATION OF TORRINGTON NEEDLE BEARINGS is simply and economically accomplished on a regular arbor press. In the intermediate clutch relay shaft bracket (shown above) as in many other applications, the compactness of Torrington Needle Bearings cuts costs by reducing size and weight of surrounding parts.

If your product can be improved by a bearing with high load capacity, unusually small size, quick installation, and efficient lubrication, investigate the advantages of the Torrington Needle Bearing. Our Engineering Department will be glad to work with



you in incorporating its advantages in your product. For more detailed information, write for Catalog No. 107. For Needle Bearings to be used in heavier service, ask our associate, Bantam Bearings Corp., South Bend, Ind., for a copy of Booklet 103X.

THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. • ESTABLISHED 1866

Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit Cleveland Chicago London, England

TORRINGTON NEEDLE BEARING

PUBLICATIONS

An illustrated 8-page booklet on the new Hycar group of synthetic rubbers, manufactured by the Hydrocarbon Chemical & Rubber Co. has just been released. The booklet is written in non-technical language, describes the physical characteristics, the comparative properties of Hycar O.R. and pictures some of the steps in the manufacture of this oil-resistant synthetic rubber.*

Lyon Iron Works' Circular No. 120 briefly describes the various **Material Handling Equipment**, including lift trucks, elevating tables, etc., most of which is hydraulic, which it manufactures.*

Johnson Bronze Co. has just released its new 1941 catalog on stock sizes of **bearing bronze**. The catalog contains as a supplement a comprehensive price list for material listed in the catalog, designated as No. 410.*

The Eastern Machine Screw Corp., New Haven, Conn., has issued a new booklet, **Defense Emergency Screw Thread Data Book**, which includes foreign and domestic screw thread systems in comprehensive tabular presentation and related technical data. The booklet is priced at 15¢ per copy.

Jessop Steel Co.'s new 12-page booklet describes **Mogul molybdenum tungsten high speed steel**, and gives physical properties, approximate analysis, hardness values at varying drawing temperatures and complete heat treating procedure.*

Caterpillar Tractor Co. has issued a new booklet which is an unusually complete discussion of **Diesel engine design**. The booklet is elaborately illustrated with cutaway photographs and a section is devoted to the horsepower ratings of Caterpillar Diesel engine.*

All-Steel-Equip Co. has issued three new catalogs, 1—**Shop Equipment**, Production aids to modern methods in material handling; 2—**Steel Lockers**, which gives complete locker specifications, construction, etc.; 3—**Aurora line of metal office furniture**.*

The Meehanite Research Institute of America, Inc., has just published Bulletin No. 12, "Design With Confidence . . . Take Advantage of Controlled Physical Properties," which describes and illustrates 12 widely varying industrial applications of the different types of **Meehanite castings**.*

Special Devices and Mechanisms for Standard Norton Machines is the title of a booklet just issued by Norton Co. The booklet is illustrated and describes special equipment that has amplified the usefulness of standard Norton grinding and lapping machines.*

Gar Wood Industries, Inc., has issued two new bulletins. Bulletin No. 2 illustrates and describes its complete line of **cam and roller hoists** for installation on all sizes of trucks, trailers, etc. Bulletin No. 11 illustrates and describes **Gar Wood hydraulic repair towers** for installation on any truck chassis rated 1½ tons or more.*

"Double Duty" is the title of a 4-page catalog just released by Experimental Tool & Die Co., featuring the **Universal Slot-master**, a slotting head, which can be adapted to all milling machines.*

A folder, "Let in the Light with Western Transmissions" has just been released by Western Manufacturing Co. Three models for motorizing cone driven machines are featured, the Master (1-5 hp.) the Major (5-10 hp.) and the Multi Motor Mount (1-15 hp. at 1800 r.p.m.)*

General Electric Co. has just released a new 60-page booklet, **Electrical Developments of 1940**. In the booklet, which reviews many developments of 1940, all apparatus referred to is produced by the General Electric Co. and associated companies.*

* Obtainable through editorial department, AUTOMOTIVE INDUSTRIES, Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

AIRCRAFT STANDARDS

(Continued from page 390)

Pumps: David Gregg, chief research engineer, Eclipse Aviation division, Bendix Aviation Corp.

Electrical Equipment: C. C. Shangraw, Eclipse Aviation division.

Instrumentation: L. N. Swisher, Sperry Gyroscope Co.

Radio & Ignition Shielding: H. M. Hucke, Radio Corp. of America.

Air Conditioning & Cabin Supercharging: W. W. Davies, assistant superintendent of research, American Airlines Transport Corp.

Valves & Fittings: J. M. Roth, chief engineer, Pump Engineering Service Corp.

Wheels, Tires, Brakes & Axles: H. F. Schippel, B. F. Goodrich Co.

Hydraulic Equipment: Harold Adams, Douglas Aircraft Co., Inc.

Heat Transfer Units: J. J. Hilt, vice-president, Young Radiator Co.

Ice Prevention & Elimination: R. L. McBrien, project engineer, United Airlines Transport Corp.

Pyrotechnics: S. G. Wiley, N. J. Fulgent Co.

All of the immediate work of these sub-committees will be concentrated upon military requirements for national defense. Members of the committee agreed, however, that out of the projects would come single standards suited to the needs of both military and commercial aircraft.

Mr. Martin's Propeller Sub-Division held its organization meeting in Washington on March 13, and undertook a nine-project program to cover cuff clearances, clearance for governors, test standards, de-icer connections, dual rotation shafts, revision of present standards, retaining nuts, control of two-speed gears and static balance tests.

Photoelasticity Meeting

The thirteenth semi-annual meeting of the Eastern Photoelasticity Conference will be held June 12-14 at Cambridge, Mass., under the auspices of the department of mechanical engineering of Massachusetts Institute of Technology. W. M. Murray is chairman of the local committee.

AIR DEFENSE

(Continued from page 394)

come an arsenal for the Navy. A \$20,000,000 Navy contract with Hudson was announced on March 18. It provides for the construction and equipment of a plant on a site acquired by the department near Centerline, Mich., in the Detroit area. The plant will make machine guns, parts of gun mounts, torpedo directors and torpedo tubes. The contract requires that the work of construction be done at actual cost plus a fixed fee to the contractor of \$350,000.

Simultaneously, the Navy announced a \$427,900 contract with the Willys-Overland Motors, Inc., for the acquisition and installation at the company's Toledo plant of special additional equipment and facilities for the production of ordnance equipment.

Defense Plant Corp. awards to automotive companies for amortization of expansion costs over a five-year period

have included Federal-Mogul Corp., Detroit, airplane engine main and rod bearings, \$469,000; Hayes Industries, Inc., Jackson, airplane wheel and brake assemblies, \$144,000; Borg-Warner Corp., Chicago, cartridge cases, \$150,000; Electric Auto-Lite Co., Toledo, fuses and boosters, \$240,000; Good-year Aircraft Corp., Akron, airplane surface parts, \$404,000; Spicer Mfg. Corp., Toledo, truck parts, \$1,428,000; Thompson Products, Inc., Cleveland, airplane engine parts, \$642,000; Timken Roller Bearing Co., Canton, Ohio, electric furnace steels, \$3,639,000; Republic Aircraft Products Division of Aviation Mfg. Corp., Detroit, aircraft engine parts, \$1,500,000; Willys-Overland Motors, Inc., Toledo, ordnance equipment, \$427,000.

Recent national defense orders to automotive plants included \$900,000 to AC Spark Plug Division of GM, Flint, for spark plugs; \$297,000 to Sparks-Withington Co., Jackson, for hoist assemblies; \$164,085 to Enterprise Tool & Gear Corp., Detroit, for gears; \$604,606 to Hayes Industries, Inc., Jackson, for wheel and brake assemblies; \$153,150 to Caterpillar Tractor Co., Peoria, Ill., for graders; \$601,180 to Stewart-Warner Corp., Chicago, for fuse units; \$367,905 to Thompson Products, Inc., Cleveland, for fuel pumps; \$5,120,229 to Allis-Chalmers Mfg. Co., Laporte, Ind., for artillery material; \$932,400 to International Harvester Co., Chicago, for adapters and parts.

A Letter About Arc Welding

Editor of AUTOMOTIVE INDUSTRIES:

Arc welding can easily take care of its enemies if it can only be delivered from the machinations of its friends.

Arc welding progress is being held back much more by people who could know the facts and will not than by all the people who condemn it from ignorance. This is a unique situation.

This fatherly criticism has condemned the consumer of welded products to the loss of many welding economies. It has also forced the would-be user to antiquated methods which are less reliable and more dangerous. The reasoning of these fatherly critics is that since no one can see into a welded joint therefore it should not be used. However, this same critic does not hesitate to use steel which, without question, is equally dense and much more variable in quality.

It is a peculiar quirk of human nature that the average man hesitates in adopting new ideas. This perhaps is a very admirable trait. The consumer, however, by this same conservatism, is condemned to paying more for an inferior article. Many millions of dollars of loss is incurred by him yearly because of this same conservatism. This loss can be justified for a proper trial period but not longer. This proper trial period expired many years ago.

It is time that we overcome this truly American trait in which we take so much pride. We should not allow this economical loss to continue merely because of our ideas of conservatism. After all, these conservatives do not pay the bill. That is paid by the consumer who wants progress and safety. He is tired of paying for Tacoma bridges which, if designed for welding, would have cost less and still be standing. He wants the economy and safety for a homogeneous structure which only welding gives and he wants it now.

J. F. Lincoln, President,
THE LINCOLN ELECTRIC CO.

MANY HAPPY RETURNS



ALTER EGO: Literally "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

ALTER EGO: Don't you think mebbe we could relieve the production jam by replacing those old weld jalopies with NEW welders?

Sure, but then we'd flop right back into a financial jam . . . don't let's spend money.

ALTER EGO: But AREN'T we spending? . . . aren't we spending in excessive welding costs for every welder that isn't of modern design?

Well, they do claim the new Lincoln is faster.

ALTER EGO: S'pose it boosts our speed 10%. That'll save us about \$200 per year per welder.

Sounds good.

ALTER EGO: And s'pose we increase our speed not 10% but 20% or more—like some Lincoln users have—with Lincoln Welders PLUS Lincoln Service?

That would be Many Happy Returns on our spending—and we'd be out of the jam in the bargain. How do we do it?

• •

LINCOLN SUGGESTS: Ability to withstand the heavier loads is one reason the New "Shield-Arc" is *faster*. It permits use of larger electrodes. By stepping up electrode size from $\frac{1}{4}$ " to $\frac{5}{16}$ ", one user increased welding speed 43%—cut cost 25c per pound deposited. What can *you* do? All "Shield-Arc" features are explained in Bulletin 412 (gratis).

Copyright 1941, The Lincoln Electric Co.,

LINCOLN "SHIELD-ARC" WELDING

THE LINCOLN ELECTRIC COMPANY
Cleveland, Ohio

Largest Manufacturers of Arc Welding Equipment in the World

Mass Production of Skilled Workers

(Continued from page 367)

tasks in the manufacture of aircraft power plants even though one cylinder of a Double Wasp engine generates more horsepower than an entire Mercury eight-cylinder motor.

"Every manufacturer of automobiles has hundreds of men who have been working for years at tasks requiring degrees of craftsmanship and skill as great as the finest required in making aviation engines," asserts Searle. "It is nonsense to indulge in loose talk

mended by their principals, 18 or 19 years old, and residing in Detroit or environs. Only about one in 40 applicants is accepted.

Upon transfer to the aircraft apprentice school, trainees will start on the special duty machines and branch out to the more skilled jobs as they progress. The aircraft apprentice training period will cover two years. Students are paid 55 cents per hour while enrolled in the Training School

General Motors Corp., which has the task of training upwards of 60,000 workers for the national defense program, finds its greatest task in the Allison Engineering Division at Indianapolis. Allison, which boasts \$190,100,000 in defense orders, had only 900 employees in November, 1939, before going into mass production of the liquid-cooled, 1090 hp. aircraft engines. Payrolls now total 8,000 men, of whom about half were given instruction as trainees, and are expected to rise to 10,000 shortly.

Only 25 per cent of Allison's 5,500 production workers were rated as experienced when they were hired. A vestibule school for new workers has been set up, in which they undergo pre-employment training of one to two weeks, the last two days of which are spent on the particular machine they will operate in the plant. The school has a capacity of 100 men per week, being limited by a shortage of machine tools, which cannot be sacrificed for training purposes during the defense emergency. The trainees work on scrap materials before graduating to a place in the plant, where they learn the machine operations under the guidance of an experienced employee.

After being placed in a production job, new workers can enroll in outside classes, such as blueprint reading, shop mathematics and the use of precision instruments, to improve their skills and advance to a higher classification. Such enrollment is voluntary and many of the classes are held at night to accommodate day shift workers.

Classes also are held for foremen, taught by field instructors from General Motors Institute at Flint. These classes, covering the principles of supervision and the technique of teaching new machine operators, are held once a week for one and a half to two hours over an eight-week period. Three hundred and forty Allison foremen are taking such courses at present.

Cadillac Motor Car Division in Detroit, where more than 30 of the Allison parts are produced, has 1,800 men employed in the aircraft section, of whom about half can be classified as "green workmen," according to General Manager Nicholas Dreystadt. Yet Cadillac has been able to turn out aircraft engine parts that meet stiff inspection standards.

"As an obvious advantage," explains Dreystadt, "we are an old-line company with an abundance of precision craftsmen. Our employees are familiar with the close fits that characterize aircraft specifications. Through experienced precision men, we had at the outset an



Allison workers attend voluntary classes in advanced work to qualify for better jobs requiring increased skill.

about greater accuracy being required in aviation engine manufacture than is common in automobile manufacturing practice. Many of the automobile tolerances are closer, although the smooth finishes of aircraft engine parts are finer."

Ford will have a full quota of 2,000 boys in the aircraft apprentice school by June. Six hundred boys, entering at the rate of 200 a month, are now enrolled in the Ford Training School, one of the three Ford industrial schools, preparing for eventual aircraft work. During the three-month course they engage in eight hours of shop work daily and also take two hours of classroom work per week, chiefly mechanical drawing and shop mathematics. They must be high school graduates recom-

and then are raised to 75 cents per hour upon being transferred to the plant after the three-month period. The best qualified of the Training School graduates working in the Rouge plant will be selected for responsible positions in the aircraft engine factory.

Enrollment in the three Ford industrial schools is up about 33 per cent, or to 8,000 boys, due to the national defense emergency. Of these, 6,000 are studying in the two-year apprentice course, designed for sons of employees and from which are recruited many of the River Rouge plant specialists and supervisory force, while 1,800 are taking the four-year apprentice course comparable to a vocational school. There are now 350 instructors in the three schools, 100 having been added in the last year.

excellent staff nucleus. Supervisors transferred from our automotive departments formed the framework for the Allison venture.

"For our raw material we went after the young man with some trade or technical school background who had been unable to find steady employment. The romance that surrounds anything associated with aviation and an opportunity to help in a national emergency undoubtedly simplified our problem. The most promising applicants between 18 and 25 were selected."

As the first stage in Cadillac's training program, 500 new employees were introduced to hand polishing jobs of parts such as crankshafts and connecting rods, which in an airplane engine must be mirror-smooth because breakage results when vibrations set up stresses wherever metal is nicked or scratched. This sanding and polishing operation permitted the new workers, 95 per cent of whom were without machine shop experience, to get the "feel" of the shop without being put to a severe test that might jeopardize factory output. Those showing the proper qualifications were given a five-cent-an-hour pay raise every 30 days until the end of 90 days, when they were ready for a more detailed course of instructions. This section of the Cadillac plant has been dubbed "Boys' Town" because of the preponderance of youthful workers.

Dreystadt makes an apt differentiation between normal manufacturing and the production which is taking place in the defense emergency.

"When we speak of a skilled machinist in the automobile trade," he says, "we mean a machinist capable of handling almost any kind of a machine. Due to fluctuating automobile demand and the varied production habits of plant equipment, it is important for a workman to understand several types of machines if he is to keep continuously employed. In the sharply increased consumption of armament parts, an emergency exists that does not permit a deliberate grounding in, say, the machine trades. For aircraft parts production we have trained a man for a particular machine. We have endeavored to ground him thoroughly on this machine, but only on this one."

"Now so far as the man himself is concerned, he does not need to concern himself with other machines because there will be no fluctuations in his job. The productivity of the machine is underwritten for the duration of the defense emergency. Beyond that we cannot, at the moment, plan."

To get machinists, Cadillac has sent inexperienced men as "helpers" into the automobile factory. The man to whom the newcomer is assigned is fully capable of handling his job without assistance but he shows an unselfish interest and teaches the unskilled man his job. Skill is contagious. In a short time the new worker has become adept enough to replace the automobile ma-

chinist, who then can be transferred to the production of Allison parts.

Packard Motor Car Company is using this method to form the nucleus of the more than 10,000 production workers who will be at work next fall on an order for 9,000 Rolls-Royce Merlin aircraft engines. Packard is using its marine engine division as a training ground for these men before actual aircraft engine production gets under way in August. The exacting requirements of the 1,350 hp. Packard marine engine make it quite similar to the 1,200 hp. Rolls-Royce Merlin. The tolerances and techniques are practically the same.

Men from the Packard automobile production departments have been transferred to the marine division for training periods of one to three months under experienced instructors. These classes include textbook study, technical instruction and actual work on the engines. Packard expects to transfer from 2,500 to 3,500 of its 10,000 automotive workers to aircraft and then fill in the balance of both divisions with new workers taken from the company's reserve labor list, former workers who returned to rural communities when work was slack, and Detroit's floating labor supply.

Wright Aeronautical Corp. at Pat-

When Machine Tools CHATTER

or Bearings
and Gears
run
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erson, N. J., which turns out high-powered aircraft engines for the Army and Navy, has three specialized training projects which have helped to boost the Paterson working force from 3800 employes in September, 1939, to 16,000 at present. Under one plan, four-week pre-employment courses are given in several Paterson public schools, with most of the instructors veteran Wright employees. Applicants must be between 20 and 30. The first week is devoted to classroom work covering four subjects: review of arithmetic, shop science, blueprint reading and use of measuring tools. The next three weeks are given over to intensive instruction

on the particular machine which the student will operate in the Wright plant. Successful completion of the course qualifies the student to be placed in the plant under supervision of a skilled operator.

Four weeks of observation under the regular operator, which, incidentally, does not hamper production, qualifies the trainee for assignment to a special group, where he works up to more complicated operations in six to eight weeks. After mastery of these operations, he is transferred to a regular production group.

Of 582 recent graduates, 155 worked on engine lathes, 74 on milling ma-

chines, 67 on drills, 73 on gear cutting machines, 107 on grinding machines and 106 on screw machines.

Wright also has revived an apprenticeship program under which boys 18 to 21 undergo a thorough four-year course in one of three classifications: toolmaker, machinist or wood pattern-maker. In expanding its supervisory force, Wright also has adopted a conference training plan for foremen. Eighteen divisional supervisors have been trained as conference leaders to instruct the other foremen in teaching technique and other problems of supervision.

To help man its huge new plant now being built at Lockland, Ohio, which eventually will produce 1,000 engines per month with a working force of 12,000 to 15,000 men, Wright has worked out an arrangement with the neighboring American Rolling Mills Co. plant at Middletown, O. Armco machinists, who have been laid off due to a change in manufacturing processes, are taking training courses to fit them for jobs at Lockland when that plant opens in June.

General Motors Institute at Flint is the key point for that corporation's defense training program, which has many ramifications and extends into 40 plants. Under the direction of Maj. Albert Sobey, 13,000 men are being trained directly in an expanded program which keeps shops and classrooms going day and night. The Institute provides field men and textbooks for training courses in the various plants.

An intensive two-week course to train administrators and job analysts recently was attended by 15 men from six plants. Field men are training 1,500 foremen, supervisors and set-up men for added defense responsibilities, especially the breaking in of new workers. Spare-time courses designed to upgrade workers at Flint plants have shown a 100 per cent increase in enrollment since the defense emergency. Some workers come from as far away as Pontiac, 30 miles distant, to attend these 12-week night courses.

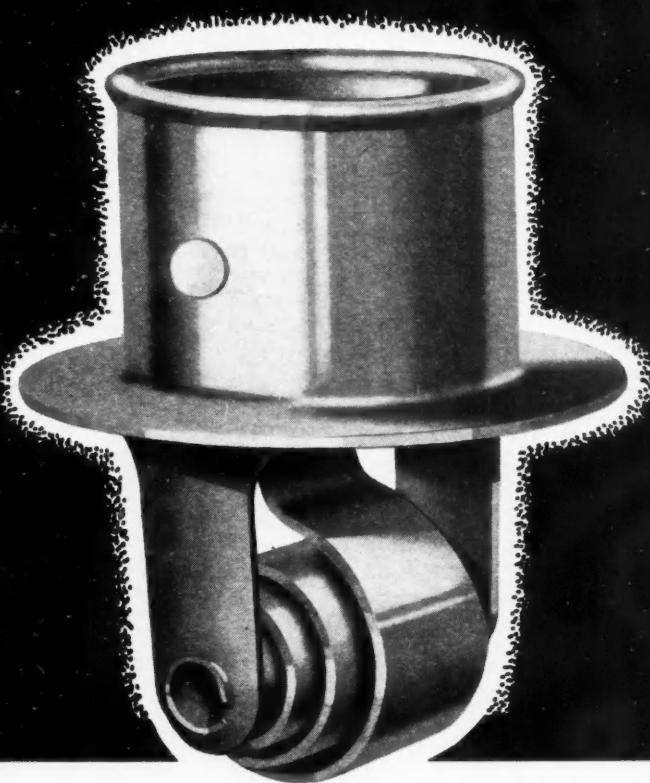
Each company, be it General Motors with an eventual increase of 60,000 workers or the small-town machine shop adding five new men, has its own particular training problems in the national defense program. But the emergency is being met, as is well attested by the continually larger flow of armaments and defense materials from the industrial plants of the U. S.

Used Car Market Sales

Automobile dealers of the United States average 23 used cars on hand as against 22 a year ago, an increase of 4½ per cent, which is offset by the large gain in new car sales and a yearly increase of 11.1 per cent in used car sales, according to a survey by the National Used Car Market Report, Chicago. While other sections of the country showed a slight gain in used cars in the hands of dealers, a decrease of 16 per cent is reported for the southern states.

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Thermostats

FITTINGS

Involute Splines by the Shaving Method

(Continued from page 377)

From 26 to 38 splines are used on the three standard sizes of shafts produced, giving the appearance of a series of serrations around the stub end of the propeller shaft, the diameter of which is approximately 2 inches.

To provide maximum accuracy of tooth profile, rack type Michigan gear shaving equipment is used. The machines are the series 900 type, in which the gear is mounted between live centers. A generating rack is reciprocated in mesh with the gear while the head of the machine, carrying the work, is fed downward. With this type of equipment, accuracy of tooth profile is almost entirely dependent on the accuracy of the serrated blades of the cutting rack. A production rate of some 70 to 80 pieces per hour is obtained.

The rack itself has approximately 100 teeth, giving from 3 to 4 revolutions of the part for each stroke of the rack. In practice, some 12 to 16 strokes of the shaving rack are used to finish the splines.

The splines are so designed that the same rack can be used for finishing all parts, all splines having the same pitch and pressure angle. The rack differs from conventional gear shaving racks mainly in the larger number of blades required for the fine pitch.

Prior to the shaving operation, the stub ends are semi-finish hobbled in Cleveland single-spindle and 8-spindle rotary machines. Each shaving machine takes care of the output from four or more single-spindle hobbing machines. MITCO 3-thread hobs are used. Due to the use of shaving equipment for finishing, Class B hobs can be utilized. The hobbled shape of spline formed is roughly indicated by specifications for the hob which, for the 38 spline stub end, is 21.111 pitch, 20 degree pressure angle, 2° 14' thread angle and lead 0.192 in. The feed is 0.10 inch per revolution of the work. The length of splined end is approximately 3 inches.

To check the spline dimensions in production after both hobbing and gear shaving operations, an 0.080-in. diameter wire is inserted between the teeth on opposite sides of the spline, the size being such that the wires do not bottom in the splines. Following the hobbing operation the limits are from 1.915 to 1.917 inches across the wires. After the shaving operation the limits are from 1.9075 to 1.9085. Actually the limits are much closer than these figures in both cases, due to the contour of the teeth on the splines, which multiplies any variation in dimensions several times. Accurate gaging of the tooth dimensions shows that they seldom vary more than 0.0001 in. and never exceed 0.0002 in.

The mating part—the propeller shaft end—is broached to similarly close tolerances. This operation is performed on a broaching machine, equipped with three broaches and rotary table. The broaches used are of the Colonial hardened and ground precision high-speed steel type and successively broach the

hole, semi-finish and finish the splines. Due to the method of producing the parts, the type of fit secured is identical regardless of the relative rotational positions in which the mating parts are assembled. The fit is frequently checked with master internally splined gages to maintain this condition.



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WHEN the time comes for you to buy springs, give thought to the quality and service you can get from Accurate. Whether the spring you need is the tiniest hair-like coil or a stout steel brute for slam-bang service, you'll find that Accurate controls and checks quality to the "nth" degree. Accurate builds dependability into its products to help you build it into yours. Accurate takes more than ordinary measures to meet delivery dates to help you meet yours. This care is building business for Accurate. It will help do the same for you. Let Accurate meet your next spring requirements — write today.



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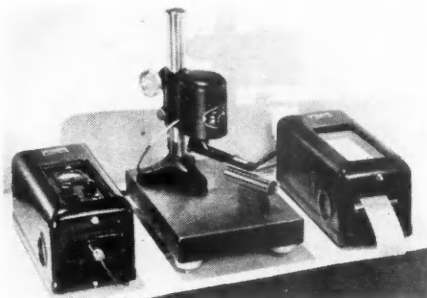
MEN and MACHINES

(Continued from page 385)

Jackson, Mich., is especially designed for the tool, die and experimental shop for milling, boring and drilling. It has a capacity of $\frac{1}{8}$ to $\frac{5}{8}$ in. end mills in tool steel, and has six standard spindle speeds ranging from 180 to 2400 r.p.m. with single-speed motor. Special two-speed motor is also supplied. It is equipped with longitudinal and cross verniers for locating milling and bor-

ing positions. Spindle travel is $3\frac{1}{4}$ in., maximum distance from end of spindle to table 16 in., minimum 0 in.

AMONG the new products of the George Scherr Co., New York, are the Comparitol, a precision measuring instrument; the Ultra-Chex Inspectoset, Wilder Micro Projector, GS Dial Test Indicator, and the Magni-Ray, a



Brush SA-2 Surface Analyzer, manufactured by the Brush Development Co., Cleveland, provides an instantaneous and permanent chart record of surface irregularities of less than one-millionth of an inch.



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The series of lapping operations performed as a matter of course in the Strom plant give Strom Steel Balls a degree of surface smoothness and sphericity that has always been unequalled in any other regular grade of ball. Only through such unique lapping practice can extreme precision be obtained.

Physical soundness, correct hardness, size accuracy, and sphericity are guaranteed unconditionally in all Strom Balls.

Other types of balls—*stainless steel, monel, brass and bronze*—are also available in all standard sizes. Write for catalog and prices.

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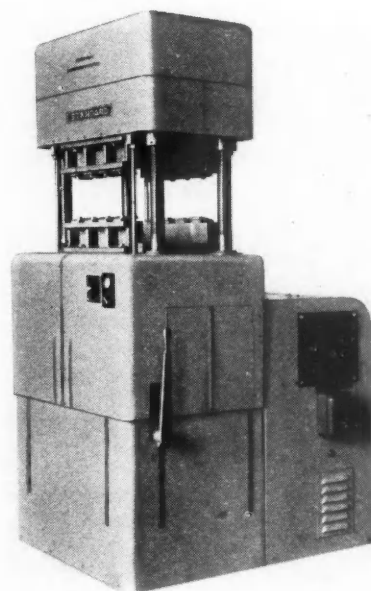
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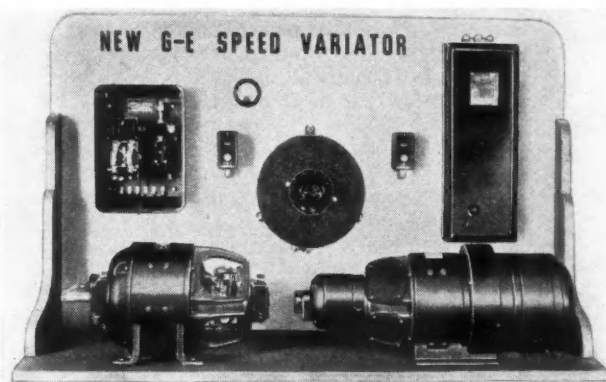
The largest independent and exclusive Metal Ball Manufacturer

wide-field illuminated magnifier. The Comparitol, which operates on a new knife-edge principle, has only two moving parts, the vertical spindle that carries the contact feeler point and a horizontal beam carrying the indicating hand. The Ultra-Chex Inspectoset consists of 34 precision length standards and will produce all combinations in steps of $1/10,000$ in. from 0.300 in. to 8 in. Measuring or comparing objects by means of a magnified shadow image is the purpose of the Wilder Micro Projector. The Magni-Ray inspection instrument is available in two models, one having an achromatic lens with a magnification field of 2 in. plus a magnification power of $1\frac{1}{2}$ in.

STANDARD semi-automatic presses, both conventional type and streamlined models, are now being made with a new "slow-closing" control feature by the F. J. Stokes Machine Co., Philadelphia. By means of this control the final closing of the mold under compression may be accurately timed for from one second to 20 minutes as may be desired. The closing speed is timed automat-



Stokes Standard press with "slow-closing" control.



*General Electric
Speed Variator.*

The new General Electric plugging switch is designed for controlling motor stopping by removing the plugging power at the correct moment to keep the motor from reaccelerating in the reverse direction.

A NUMBER of new needle bearings, specially intended for the requirements of aircraft service, have been announced by the Torrington Co., Torrington, Conn. The bearings are made in two series, designated as the "AR" series for normal service and the "AT" series for heavy duty.

Bearings in both series are provided

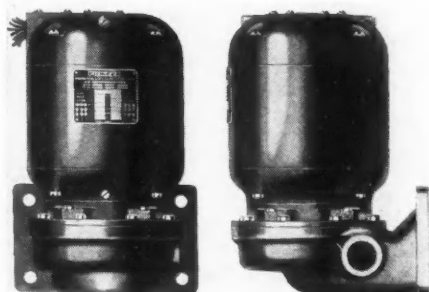
ically and duplicated exactly in each cycle.

Controlling the speed during final closing is said also to permit the use of less expensive flash type molds where they would otherwise be impractical. The control mechanism makes the press automatic in operation, except for the actual loading and removal of finished pieces. Thus closing, pre-heating, breathing, pressure and length of cure are not dependent on the judgment and accuracy of the press operator.

NEW PRODUCTS of the General Electric Co. include a Tri-Clad poly-phase induction motor, a Tri-Clad capacitor motor, a speed variator and a plugging switch. The Tri-Clad motors are designed to provide better mechanical and electrical protection as well as protection against operating wear. Their frame and end shield construction minimizes contact of vital motor parts with foreign material such as lubricants, coolants, chips and others.

The new capacitor motor is available in two types, one for applications requiring moderate starting torques such as fans, blowers and centrifugal pumps, and the other type for compressors, loaded conveyors and reciprocating pumps requiring high starting torque.

The speed variator is an all-electric adjustable speed drive that operates from alternating current supply. It consists of a motor-generator set driving an adjustable speed direct current motor. The speed is varied by the well-known system of generator-voltage control.



New coolant pump model VBA of the Pioneer Engineering & Mfg. Co., Detroit, is compact and is capable of functioning efficiently with an extremely low liquid level.

Investigate the Advantages



of Acadia Molded Synthetic Rubber Products

• Engineers throughout the automotive industries are finding new and better solutions to many production problems with molded synthetic rubber products.

There are many variations of Acadia Synthetic Rubber Products. They are produced from many formulas in molded form and provide important advantages where high heat and oil are encountered.

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Rubber parts offer greater resistance to aging, heat, sunlight, alcohol, oils, kerosene, and other destructive solvents . . . are widely used for washers, gaskets, packings, diaphragms, and other important parts.

Put your problems up to our Engineering Department, submitting blueprints when necessary. You are assured of prompt and efficient cooperation in meeting your production requirements.

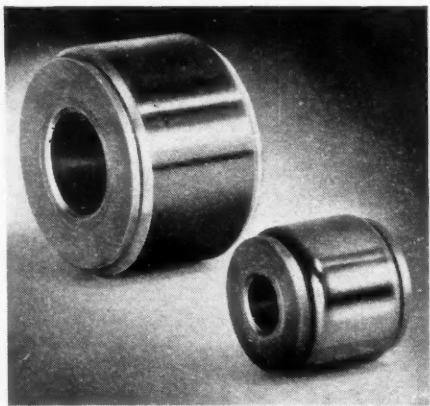
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Torrington needle bearings for aircraft.

with inner races and permanently attached end washers. All exposed surfaces are cadmium plated.

A NEW power-driven automatic bending machine, manufactured by the Parker Appliance Company, Cleveland, is primarily designed for bending up to 3 in. O.D. copper, aluminum alloy, and 2½ in. O.D. annealed steel tubing. It is also applicable for bending equivalent structural shapes.

The machine operates in two automatic cycles, the bending and the re-

turn cycle. The bending cycle consists of automatic clamping of material, bending, automatic stopping at a predetermined angle, extraction of mandrel, if used, and unclamping. The return cycle is the simultaneous return of mandrel and bending accessories to starting position.

Change-over from left to right hand bending is made quickly. Correct rotation is automatically established by a selectro-switch, which is actuated by the position of the arms. The bend angle can be conveniently set. Production of 250 right angle bends per hour is claimed for this new machine.

A NEW hand truck designed to carry an oxygen cylinder, an acetylene cylinder, and a complete welding and cutting outfit, has been announced by the Linde Air Products Co., a unit of Union Carbide and Carbon Corp. This



An Ever Widening Influence in Drop Forging Perfection

From earliest automotive years Atlas has been a consistent leader in Drop Forging development. Often working ahead of precedent, this Company has given much to the industry. It created the first machinery for twisting multiple throw crankshafts; designed special heat treating equipment later adopted by the trade; collaborated with steel companies and universities in alloy steel research when the value of many alloys now in common use was unknown.

On the other hand, Atlas has been quick to accept processes and equipment that contributed to the betterment of Drop Forgings, thus maintaining a constantly modernized plant controlled by correct scientific methods.

COMPLETE LABORATORY AND HEAT CONTROL



Oxweld Two-Wheel Welding Truck with semi-pneumatic rubber tires.

new truck, known as the Oxweld T-7 Two-Wheel Welding Truck, is light in weight, well balanced, and has 14-in. wheels equipped with semi-pneumatic rubber tires. The T-7 weighs considerably less than the former all steel-wheeled model which it replaces.

These features make the truck exceptionally easy to maneuver. The new design results in a 4½-in. reduction in overall width of the truck, permitting passage through narrower openings. The removable metal tool box for extra blowpipes, tips, goggles, and wrenches is larger.

CHICAGO RIVET & MACHINE Co., Cicero, Ill., manufacturers of rivets and riveting machines since 1920, has entered the aircraft field with a complete line of riveters that are tooled especially for aircraft production assemblies. Among the new products

ALUMINUM, DEFENSE, AND YOU



1

WE INTERRUPT our regular messages to report what's what with aluminum.

AT THE MOMENT delivery for civilian use must make way for defense. Everybody knows the reason. Defense requires and is using more aluminum per month than peacetime America ever consumed.

NEVERTHELESS, we intend that no one shall have to forego the things aluminum can do best one minute longer than we can help.

THERE IS NO SHORTAGE of bauxite, nor of anything else, except time. And Father Time is being given the race of his life.

WE ARE MOVING, for example, 35,000 yards of earth a day at Alcoa, Tenn., to get 50 acres under a single roof by September. It will require 193 carloads of roofing felt. Some of the operations in that plant will start even before the walls are up. That's an annual rolling capacity for 120 million pounds of high strength alloy sheet coming along fast.

LAST MARCH WE STUCK the first shovel in a cow pasture near Vancouver, Wash. In September a 30 million pound plant was delivering metal. It has been doubled, already. A third 30 million pound unit starts delivering in April; a fourth in May; a fifth in June. From cow pasture to 150 million pounds annual capacity in 15 months.

A SIDELIGHT: To make that 150 million pounds of aluminum, we first have to build factories to make 120 million pounds of carbon electrodes. We have to obtain the equipment (transformers, rectifiers, and the like) to feed 162,500 kw. of electricity into the reduction furnaces. This is a generating capacity equal to that of the state of Delaware plus twice that of Mississippi.

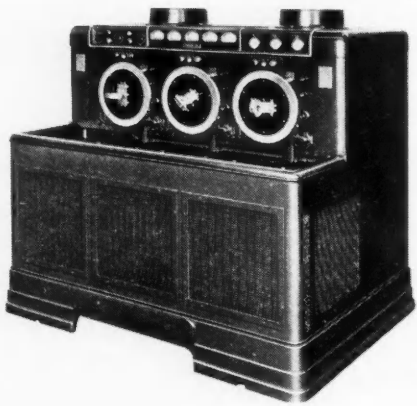
WHAT OF TOTAL PRODUCTION? In addition to Vancouver, further installations are being made at other of our plants, so that in less than a year their total capacity will be more than double that of 1939, when 327 million pounds were produced.

IN THE VERY MIDST of this demand we have lowered the price of aluminum ingot 15%. We state, without reservation, our hope that the price can be still further reduced.

DEFENSE APPLICATIONS use aluminum for exactly the same reasons you do. Defense priorities on aluminum simply say that there are some fundamental things that aluminum does supremely well. It will do them still better as important lessons in production, fabrication, and application are learned from every additional pound being produced and used.

YOU, SIR, have been using aluminum pistons and cylinder heads. We want you to know that we intend to make any shortage as short-lived as possible. Your aluminum is on the way. It is a promise.

ALUMINUM COMPANY OF AMERICA



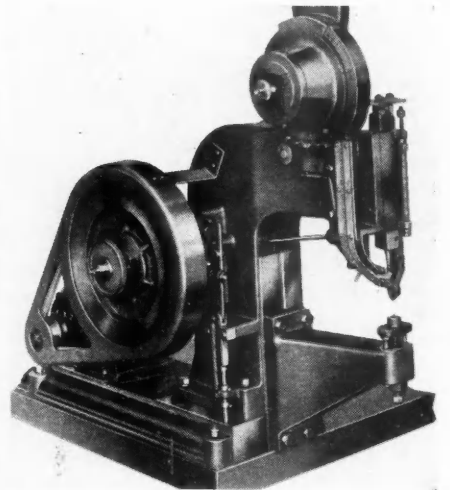
New three-station Tocco MG-10 Junior machine with universal transformer panel announced by the Ohio Crankshaft Co., Cleveland.

are four automatic rivet-setters comprising Model 13 with an eight-inch throat depth, Model 71, nine-inch throat depth, Model 90, 12-inch throat depth, and Model 140, 24-inch throat depth. All are made in the floor type with Model 71 also available in the bench type as illustrated in these columns.

With the exception of Model 13, the others are designed for setting aircraft

rivets up to 3/16-in. dia. and 3/4-in. in length. The rivet capacity of Model 13 is 1/8-in. dia. and 3/4-in. long.

These machines automatically feed, insert, and upset rivets at a single machine stroke. Their capacity is said to be up to 2400 rivets an hour except the smallest model. Machine tooling such as feeding mechanism, horn, anvil holder and anvil can be supplied to meet the requirements of special assemblies.



Model 71 aircraft automatic rivet-setter, bench type.

The Leaders *improve engine run-in with* **COLLOIDAL GRAPHITE**

The leading builders of airplane, automobile, tractor and motor-cycle engines lubricate the run-in with "Oildag". Free and efficient action is more rapidly accomplished and closer tolerances maintained, when "dag" colloidal graphite is blended with the lubricant. ♦ ♦ Others who recognize that colloidal graphite improves run-in are manufacturers of lathes, presses, precision drills, pumps, reduction gears, compressors, crusher equipment, small mechanisms ♦ ♦ Ask your oil supplier about his colloidal graphited industrial lubricants to speed your production. ♦ ♦ Send for Bulletin No. 112.4 "The Value of Colloidal Graphite for Assembly and Running-in".

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

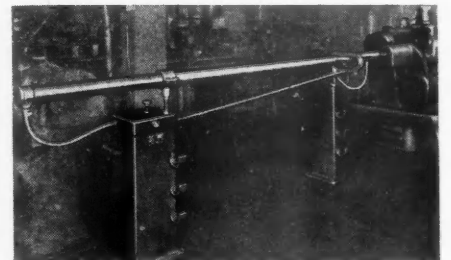


A SELF-CONTAINED automatic power stock feed device of the pneumatic type is being manufactured by W. C. Lipe, Inc., of Syracuse, N. Y.

The unit consists of an air cylinder sufficiently long to contain a full length stock bar, open at the forward end, and adjustably mounted on two fabricated steel standards. Within the cylinder is a piston having a ball bearing cup center, which supports the free end of the stock.

Air is supplied to the cylinder at very low pressure, and forces the piston forward against the end of the stock, thus causing piston and stock to move forward instantly when the collet is opened.

When the piston reaches the forward end of the cylinder the air pressure is automatically shut off and forward motion of the stock ceases. When the unit is reloaded, the new stock pushes the remaining short length until it is completely used. A coupler tube which



Lipe Pneumatic Bar Feed.

floats in the spindle bore of the machine tool supports the forward end of the new stock in alignment with the short piece and guides it into the collet of the machine.

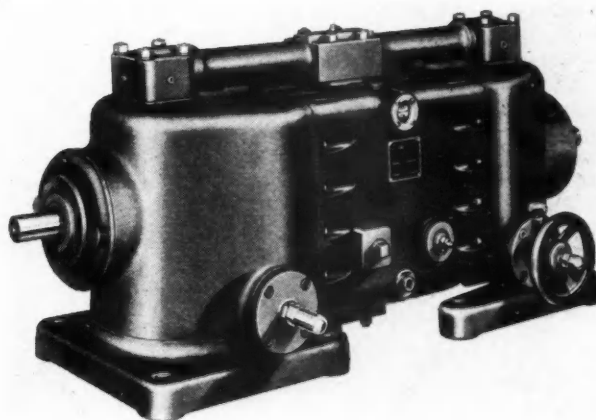
The Lipe Pneumatic Bar Feed is available in the following models for hand screw machines and turret lathes: Model 125—Capacity 1-in. dia., 12 ft. long; Model 225—Capacity 2-in. dia., 12 ft. long; Model 300—Capacity 2½-in. dia., 12 ft. long.

VICKERS, INC., Detroit, has announced eight new products, consisting of motorpump units, a new series of solenoid operated valves, pressure switches, automatic hydraulic press control, rotary piston type variable displacement fluid motors, hydraulic variable speed transmissions, two-way traverse and feed control panel, and an automatic hydraulic machine control.

The Vickers motorpumps are available with both single and double end motors, and with single or multiple pump mountings in sizes ranging from ¼ hp. to 150 hp. The pressure switch, which incorporates an automatic pressure surge damping device, is designed for oil hydraulic machinery operating at pressures up to 3000 lbs. per sq. in. Elimination of shock in the operation of hydraulic presses is the purpose of the valve in the automatic hydraulic press control. Designed for operation at exceptionally high rotative speeds and at pressures up to 1500 lbs. per sq. in., the rotary piston type fluid motors provide a compact unit for the development of rotary mechanical power from fluid pressure. They are available in sizes from three to 300 hp.

The Vickers hydraulic variable speed transmission unit provides means for smooth starting and stopping, reversing, overload protection and stepless speed control when arranged between a continuous speed prime mover and the driven machine. Various types of manual and automatic control arrange-

Vickers hydraulic variable speed transmission.



TRADE **AUTOMATIC** MARK

Manufacturers for Over Thirty Years

MODERN **Electric Propelled INDUSTRIAL TRUCKS**

FOR ECONOMICAL MATERIALS HANDLING IN AUTOMOTIVE AND AIRCRAFT INDUSTRY

Since its inception "AUTOMATIC" has continually applied new scientific research and engineering technique combined with new production methods in the development of new type Electric Materials Handling Equipment to meet the demands of Automotive and Aircraft Industries.

The various trucks illustrated here are fitting examples of "AUTOMATIC" progress and achievement. Compared to the First type "AUTOMATIC" built, they reflect the ultimate in Modern Design—Sturdy Construction—Greater Capacity—Increased Efficiency—Economy Performance—Flexibility with Speed and Safety.



High Lift Skid Platform Type

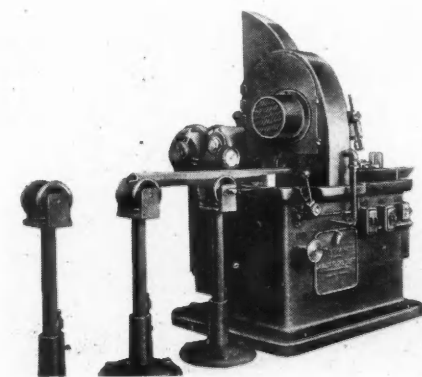
Low Lift Skid Platform Type

Fork and Ram Trucks
Telescopic and Non-Telescopic for
Pallet and Coil Handling

Die Handlers Heavy
Duty Type
Telescopic and Non-
Telescopic for Pallet
and Coil Handling

Coil and Sheet Handlers

Platform Type
with pneumatic tires



Elimination of burning, surface hardening, and glazing are claimed for the new Cutomatic Wet Abrasive Cut-Off Machine of the Andrew C. Campbell Division of the American Chair Co., Bridgeport, Conn. Due to the oscillating movement across the surface of the cut, no heat problem is said to exist in cutting a six-in. solid bar.



Listed Under Reexamination Service of
UNDERWRITERS' LABORATORIES

AUTOMATIC TRANSPORTATION CO.

57 W. 87th St.

Div. of the Yale & Towne Mfg. Co.

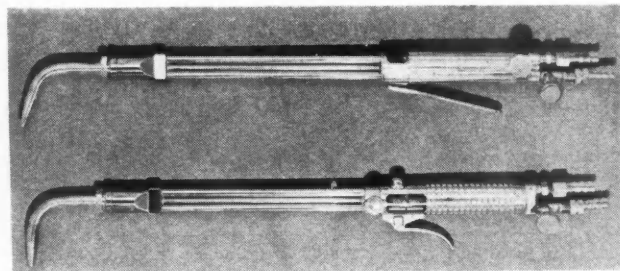
CHICAGO, ILL.

ments are available for use with these transmission units.

Operating cycles for machine tool tables or heads that require rapid advance and feed in both directions of motion are provided in the new two-way hydraulic traverse and feed control panel. Featured in it is the automatic machine cycle control that is entirely solenoid controlled and designed for cycles incorporating rapid advance, feed, rapid return and stop.

IN RESPONSE to an increasing demand for greater convenience in removing riser heads from metal castings,

Air Reduction's new torches for removing riser heads from metal castings.

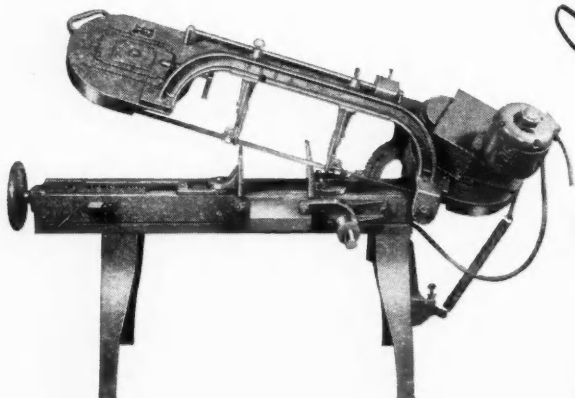


Air Reduction of New York City has introduced a new line of hand cutting apparatus consisting of two torches and three tips. The new torches, styles 3180 and 9080, are of the straight head type

and have monel metal heads and stainless steel tubes. Each is 21 ins. in length. Oxygen can be controlled by either a lever or trigger, and the type selected can be placed on top, on either side, or on the bottom of the torch to suit the convenience of the individual operator. The new cutting tips are known as style 187, bent to 75 degrees; style 181, bent to 90 degrees, and style 191, which is a straight tip, seven inches long.

While designed especially for cutting risers, this new Airco apparatus is also used successfully for removing rivets, for construction and repair jobs in shipyards, and as standard hand torches for regular and other special applications.

Has your plant **SAWITIS?**



Now Built in 3 Sizes:

- No. 5—5" diameter round or 5"x10" flat
- No. 8—8" diameter round or 8"x16" flat.
- No. 12—12" diameter round or 12"x16" flat.

Also the No. 9 Upright saw.

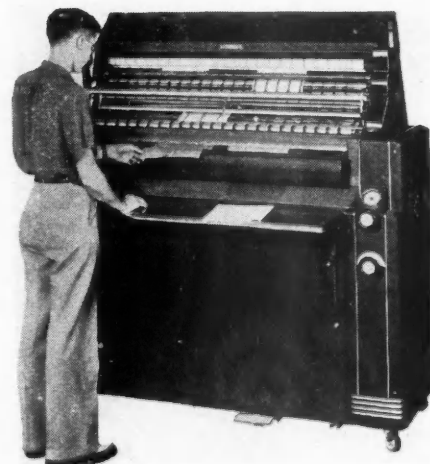
SAWITIS is a plant disease similar to the human ailment: *Anaemia*. The symptoms are: loss of production line "pep," frequent bottlenecks due to cut-off room breakdowns, and high stock mortality rates because of inaccurate metal cutting. One or all of these symptoms will cause high blood pressure in the cost department. The recommended remedy is Wells Saws. Their fast accurate cutting and dependable service backed by years of saw-building experience will cure the most tenacious case of *Sawitis*. Sold through leading Mill Supply Dealers—or write direct.

WELLS MANUFACTURING CORP.
THREE RIVERS • MICHIGAN

WELLS METAL CUTTING BAND SAWS

A NEW developing machine for greater print production has been announced by Charles Bruning Co., Inc., New York. Known as the Bruning No. 159 Volumatic Developer, the machine is designed to be used with the Bruning Model "75" BW Printer.

In using the No. 159 Volumatic Sheet Developer, which is automatic in operation, the sensitized paper and tracings are fed into the machine at the front, where they are immediately exposed in the printer section. A vacuum separator roll at the discharge point of the printer separates the tracings from the exposed prints, allowing the prints to pass automatically to the developing and drying sections of the 159 Developer. The tracing is returned to the operator, while the completely developed print is delivered flat and dry at the rear of the machine.



Bruning No. 159 Volumatic Developer.

WHERE *A*pppearance AFFECTS PROFIT

**FINISH PROTECTION IS *Important*
TO MANUFACTURER—DEALER—USER**

While you shouldn't "judge a man by his coat", people are apt to judge business houses by the appearance of their trucks. Clean, rust-free, fine appearing trucks attract attention, create a good impression and mean more business. More business means more profit.

It is easier and cheaper to maintain fine appearance on the Bonderized commercial vehicle. Cabs, Bodies, Fenders, Hoods and other sheet metal hold their finish and make fewer trips to the paint shop. Bonderizing is economical for the manufacturer to apply, is a decided sales asset for the dealer and a money saver for the owner.

If the truck you sell is Bonderized, it is good business to tell your prospect about it—it is good business for the prospect to buy it.

PARKER RUST PROOF COMPANY • 2178 E. Milwaukee Ave., Detroit, Mich.



SEND FOR THESE BOOKS

For 26 years this company has devoted its entire resources to the improvement of rust-proofing methods. Books describing the Parker Processes are available to manufacturers and technical men. Send for your copies.

PARKER
Processes **CONQUER RUST**
BONDERIZING • PARKERIZING



*Federal rifle and
gun gage.*

FOR CHECKING the lands and grooves of gun barrels, Federal Products Corp., Providence, R. I., has introduced Model G3F P-28 gage, which is shown inserted in a 37 mm. anti-aircraft gun, in the accompanying illustration. The insert shows the head of the gage, which consists of three sensitive contact points and three guide points.

The entire head revolves, so that the guide points as they move down the grooves, will rotate the head as the gage is inserted down the gun barrel. This allows the contact points to follow the grooves for diameter, out-of-roundness and taper. The lands of the gun barrel can also be checked in the same way. The guide points prevent the

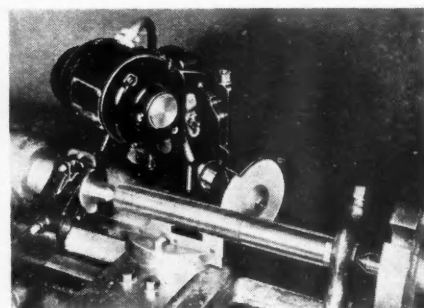
contact points from slipping off the lands into the grooves.

The barrel of the gage itself is graduated in inches so that the inspector can determine how far in he is checking at any time. Contact points are contracted by simply pulling on the trigger beneath the dial indicator. The usual Federal pistol grip is used on this gage.

A NEW development of interest to production personnel responsible for the final finish processing of bores is the Automatic Microsize Control Unit of the Micromatic Hone Corporation, Detroit. It generates accurate sizing in high production uniformly within limits from .0002 to .0005 in., thus reducing the tolerance range and number of selective fits.

The mechanism is arranged with visual dials to facilitate set-up, adjustment, and complete operating control. Additional controls provide for instantaneous abrasive expansion only to average rough bore size, followed by a controlled uniform rate of abrasive expansion feed-out to uniform size and finish, expansion collapse of abrasive members to the same starting diameter, and automatic compensation for average stone wear. A final surface finish from three to five microinches, r.m.s., can be obtained on piston pin holes, cast iron valve guides and other parts.

IN TENDED to replace a high pressure pump and thus permit the use of a lower horsepower motor, a hydraulic pressure booster for converting pressure from a low pressure pump into high pressure is being offered by the Racine Tool & Machine Co., Racine, Wis. The booster is a self-contained, self-lubricating unit of compact leak-proof construction and is of particular value in plants specializing in coining, molding, punching, shearing, and other operations requiring high pressure actuating power. It is available in six sizes from a 2:1 booster ratio to a 7:1 booster ratio.



Dunmore Co., Racine, Wis., manufactures this thread grinder attachment for the Dunmore No. 5 precision lathe grinder. It is a portable unit and can be mounted quickly on any thread grinding lathe.

INDIUM'S



Our long years of pioneering research with INDIUM to develop this miracle metal for the needs of Industry are now rewarded. Today, engineers are enthusiastic about the performance of INDIUM treated bearings and surfaces because only a small percentage of INDIUM greatly strengthens non-ferrous alloys and is the best defense against wear and corrosion. On land, on sea, and in the air, INDIUM proudly contributes to the speed-up efficiency of the Nation's program of Preparedness.



This trademark assures optimum quality, pure INDIUM of standard effectiveness.

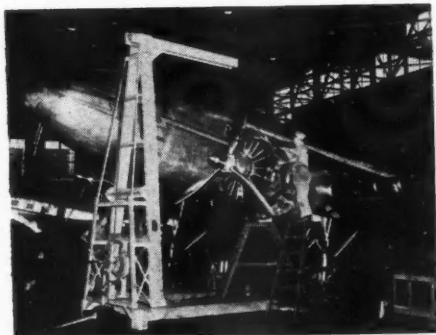
Informative literature on request.

THE INDIUM CORPORATION OF AMERICA

Research and Development Office
60 East 42nd Street, N. Y. C.

Sales Office and Laboratory
805 Watson Place, Utica, N. Y.

PORTABLE cranes of the Lewis-Shepard Sales Corp., Watertown, Mass., are rapidly increasing in use for assembly and repair operations, especially in the aircraft field. Either hand or electrically operated, they also are made with a hinged frame to allow passage through a doorway, with a telescopic frame for work under and around overhead obstructions, with a revolving base, or with all three features com-



Lewis-Shepard crane in position for servicing an airplane engine.

bined in one crane. Interchangeable winches permit conversion of the hand models to power operation.

Shown in the accompanying photograph is a standard Lewis-Shepard portable crane at La Guardia Field, N. Y., where it is in use during overhaul of airplane engines on American Airways liners, for lifting or lowering the engine into position.

TO FACILITATE frequent inspection and to tell at a glance whether pump type extinguishers have been tampered with or used, Pyrene Gardeseals have been introduced by the Pyrene Manufactur-



Fire extinguisher protected by Gardeseal.

ing Company, Newark, N. J. These Gardeseals are bright red, trademarked, visual handle seals that are destroyed the moment an extinguisher is taken from its bracket. Gardeseals, easily applied by soaking in water and placing over handle and bracket, shrink to a tight seal in an hour.

Defense Expenditures at Timken Total \$4,000,000

Defense expenditures at the plants of the Timken Roller Bearing Company have continued in recent months until they now have reached the \$4,-

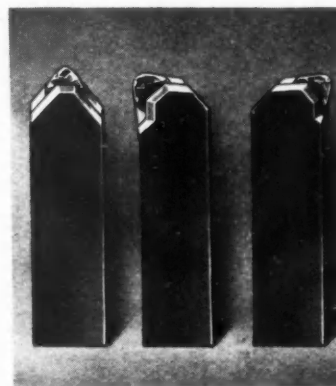
000,000 mark. Approximately one-fourth of this amount has gone into new building construction and the remainder into new manufacturing machinery and equipment. Additional projected expansion will bring the total to \$5,000,000 by mid-1941.

Stuart Co. Expands

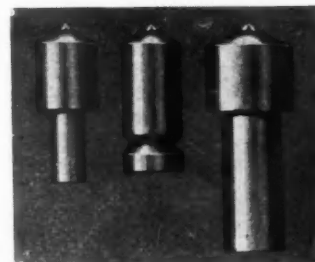
The D. A. Stuart Oil Co. is expanding its plant facilities in Chicago with a new two-story and basement addition which will provide an additional 3000 sq. ft. of manufacturing space. The total construction and equipment cost will be approximately \$50,000.

THE BETTER THE TOOL the better the machine

With an investment of several thousand dollars in a machine and five to ten dollars per day in wages for the operator, how important it is that the cutting tool be the finest obtainable. If a diamond tool costs several times as much as any other kind, it is usually an exceedingly profitable investment, for nothing else can approach the diamond in hardness and cutting qualities. This fact is doubly important today with our tremendous



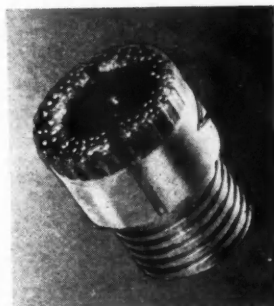
Shaped Diamond Turning Tools surpass all others for speed, accuracy and finish.



Left to Right—Landis Nib, Norton Nib, Cincinnati Nib.



Diamond Wire Drawing Die, unequalled for fast, accurate wire drawing.



Core Bits set with Bortz, used in mining, blasting, foundation and exploratory work.

defense program calling for every last possible ounce of production.

And when buying diamonds for setting in various kinds of tools, or the complete tools, be sure to give careful consideration to the source. Anton Smit & Co. has specialized in industrial diamonds for over thirty years. The Company controls all steps in the production of diamond tools—mining, importing, tool making and servicing. Large stocks of Bortz, Carbons, Ballas, Cleaved or Natural Points, Diamonds for Dies, Glazier Diamonds, Phonopoints, Crushing Boart, Splint Powder, etc., in all sizes and qualities on hand. Send for illustrated folder and prices or send blueprints for quotations on shaped tools.

ANTON SMIT & CO., INC.
24 STATE ST. (near Battery) NEW YORK, N. Y., U. S. A.

Radial Engine Building

(Continued from page 376)

on the hole size but on spacing as well. The pictorial section shows the necessary case held in a precision drilling and indexing fixture fitted in one of the big American Hole Wizard Radials.

Finally, it may be noted that the principle of keeping the atmosphere free of dust and dirt has been extended to the facilities for the grinding and maintenance of small tools. The tool department is isolated in a small and

fully-enclosed room, equipped with a separate exhaust system leading directly to the outside of the building. Thus it is possible to carry on the job of tool maintenance without permitting any of the abrasive dust to enter the machine shop or assembly department.

Assembly Operations

As mentioned earlier, the assembly department is located in a separate

wing in the extreme southeast corner of the building. It may be emphasized at this point that the Guiberson engine has been so designed as to facilitate assembly and tear-down by major sub-assemblies, and consequently, we find a section some 5100 sq. ft. in area set apart for sub-assembly operations alone. Among the major sub-assemblies are the cylinder assembly, crankshaft and rod assembly, and the accessory case assembly.

For final assembly, there is an ingenious arrangement consisting of a steel rack which carries the full complement of parts required for one engine assembly, issued from the central stock room. Engines are built up from the major sub-assemblies on universal cradles which travel down the assembly lines. In operation, a complete engine is erected in the space of four stations, checked for timing and adjustments at the end of the line. Then each inspected engine is subjected to initial break-in on engine "lapping" machines, of which there are a battery of three in the assembly department.

From the "lapping" or break-in operation, the engines go to the test cells for the regular schedule of test runs. After completing the initial test runs, the engines are transported to the "tear down" department where they are completely dis-assembled, all parts washed in a washing machine, then shifted over to the tear-down inspection department for final checking. From tear-down, the engines go back to one of the lines in the assembly department for re-assembly, followed by the final test schedule for acceptance.

Miscellaneous Details

Consider now some of the features of the special ventilating system mentioned earlier. In the first place, all of the air in the radial engine building is taken in through a number of ventilating units which are spaced along the wall of the building. Each of the units consists of a circulating fan, cold water piping for cooling in warm weather, heating coils for winter operation. The heating coils are thermostatically controlled so as to maintain a uniform temperature.

In addition, the ventilating units include an efficient air filter for thoroughly scrubbing the incoming air. Each of the units is provided with an air-mixing damper, controllable so as to permit the desired mixture of fresh air with recirculated air from within the building.

By means of the constant forced draft ventilating system, the air within the confined working area is maintained at a positive pressure of about 1 lb. above atmospheric so as to provide a seal against the entry or leakage of untreated outside air.

For winter operation, the temperature control is augmented by a series of ceiling-mounted and thermostatically controlled space heaters which come into play whenever the local temperature tends to drop.

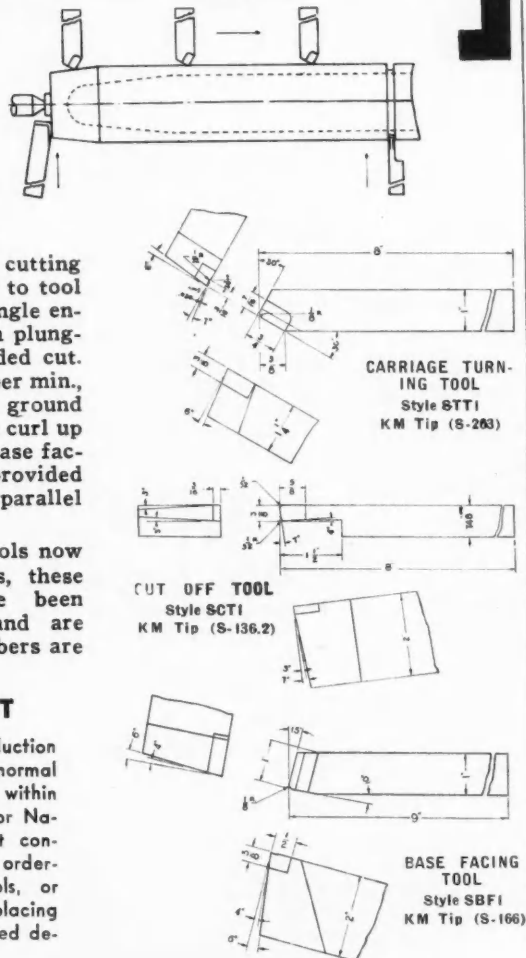
AN EFFICIENT TOOL SET UP for Machining Shell forgings with KENNAMETAL - tipped tools

Illustrated above is a tool set-up now used at one of the Government's largest arsenals for machining steel shell forgings. Note that the three carriage turning tools have a 30° side cutting edge angle, which adds greatly to tool life. The 30° end cutting edge angle enables these tools to clear when plunging into the work for the divided cut. Since they cut at about 300 ft. per min., groove-type chip breakers are ground on the tips of the tools so as to curl up the rapidly formed chips. The base facing tool and cut off tool are provided with shelf-type chip breakers parallel to the end cutting edge.

Due to the large number of tools now required for machining shells, these KENNAMETAL tools have been classified as semi-standard and are priced accordingly. Style numbers are listed under each tool.

DEFENSE COMES FIRST

We are rapidly expanding our production facilities and expect to again make normal deliveries on KENNAMETAL tools within a few months. Meanwhile, orders for National Defense must be given first consideration. You can cooperate by ordering *standard* KENNAMETAL tools, or blanks, whenever possible, and by placing your order well in advance of required delivery date.





McKENNA METALS Co.

105 LLOYD AVENUE

LATROBE, PENNSYLVANIA, U.S.A.